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For Hauling Materials From the Stock or Receiving Rooms to the Machines the Electric Industrial Tractor Offers Many Advantages.

Industrial Electric Trucks and Tractors in Machine Shops

Special Advantages of This Apparatus in Increasing Efficiency and Reducing Costs in Machine Shop Work — Its Application for Such Work—Special Opportunities for Adoption at This Time

By BERNARD J DILLON

MODERN machine shops are perhaps a better illustration than any other line of industry of the practicability and advantages of up-to-date efficiency methods. Already the majority of such shops have adopted these methods to some extent at least, and almost daily the use of them is increasing. For in order to compete economically with the newer shops the older ones are forced to adopt every conceivable method to increase production and reduce costs.

Compared with shops of a few years ago the modern shop is a revelation of progress. Efficient machines driven by the most efficient power methods take the place of many hands. These machines are so arranged or grouped as to facilitate production as much as possible.

Such machinery, however, represents a considerable investment. In order to secure an adequate return on this investment they must be operated to their fullest capacity. Specialized workmen are employed for this purpose. Such workmen are highly paid, which adds to the necessity of obtaining the utmost production. In a word, the machines and operators must be kept busy.

Formerly, when the average working day or week was considerably longer than it is now this was not so essential, for machines could be run from 10 hours per day to practically continuous operation. Under present conditions with labor everywhere demanding shorter hours, more pay, and also comparatively scarce, this feature must be considered carefully for it constitutes one of the most difficult and important problems facing such industries.

The application of an electric industrial truck or tractor offers one of the best means of solving this problem. By their use handling costs are, of course,

reduced, but, more important than this, machines and their skilled operators can be kept constantly supplied with material and tools and no time is lost in waiting or going for such articles.

In most machine shops the handling may be roughly divided into two classes.

The Elevating Platform Truck is Used Extensively for All Kinds of Handling in and Around Machine Shops.

First, bringing the material from the storerooms or receiving room to the machines or stockrooms and taking from the machines, completed, to the shipping or assembly rooms.

Second, taking it from one machine or operation to another.

Application of Electric Industrial Trucks and Tractors to Machine Shop Handling.

In the first of these the problem is simply one of handling and is similar to that of many other industries. Receiving or storerooms are located at points convenient for unloading. From here the material must be transported either directly to the machines or to stockrooms. The use of industrial electric for such work reduces the labor necessary for it, relieves congestion, is quicker and safer and in general provides many economical and productive advantages.

Likewise in hauling from the machine shop to the shipping room the problem is more often one of handling, although here the ability of the electric to handle heavy loads without any unnecessary jarring or extra handling is often a decided advantage.

The electric industrial tractor or elevating platform truck is generally used for such work. By loading the materials directly upon skids or trailers to be picked up and taken to the proper unloading point a large amount of hand labor can be eliminated. Where the haul must be made between different buildings and steep grades are encountered in the route, their advantages are particularly desirable.

The lift truck can handle loads weighing up to two tons at a speed of from 2 to 6 miles per hour. An electric tractor can haul a trailer load of 10 tons or more at about the same speed. Either of these can negotiate ordinary grades easily.

The steering and control of all types of this apparatus is very flexible and positive. Narrow aisles and passageways can be negotiated as easily as with a hand truck and as the operator has more power at his command than the hand trucker and can stop or start without any effort on his part, there is less danger from collisions or unnecessary jarring.

In the transporting of materials from the stockrooms to the machines and from one machine, operation or department to another the application of industrial electrics as a means of increasing production and efficiency is especially important. By their use there is no necessity of the operator leaving his machine to go to the stockroom or another machine for materials and delays or lost time due to lack of materials can be eliminated. By giving proper consideration to the routing and operation of the electrics and employing good, reliable operators the lower cost obtained by increased efficiency will often pay for the cost of the apparatus, leaving the saving in handling as profit.

Any type of apparatus may be adopted for such work but the lift truck or tractor is particularly desirable. With the former a number of skids can be made for a very small amount which can be arranged to accommodate the materials. These skids are loaded in the stockroom, picked up by the truck and carried to the machine. Here they can be placed in the most advantageous position for the machine operator. After completing the work on the material it can be placed in another skid which in turn is picked up by the truck and taken to the next machine. In the meantime another skid loaded with material can be brought to the first machine and the emptied skid used to receive its load.

When a tractor is used, trailers replace the skids. Heavier loads can, of course, be hauled but they can not be spotted as accurately as the skids. The selection of the type of equipment will depend largely upon local conditions. Where the quantity of materials to be handled is large, such as when a group of machines must be served at once or when the material to be handled can not be readily loaded onto skids, the electric tractor with trailers is perhaps most desirable. Where the materials consist of rather small pieces

The Utility Truck Can Also Effect a Saving in Handling Costs.

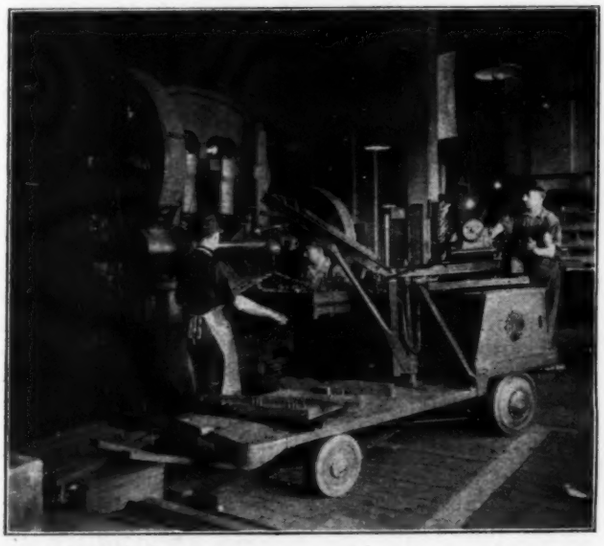
that can be dumped or loaded onto skids the lift truck is preferable. In addition, the utility or load carrying truck can also be used to advantage, especially in the smaller plants where the amount of work is small and the general utility features of this type desirable. When heavy materials must be lifted up on machines

an electric truck equipped with a crane can be used. These cranes are operated electrically and have a capacity of one ton or more.

The general utility features of any type of electric are also valuable in machine shops. These features include the hauling of extra heavy materials, moving machinery, the spotting of freight cars, etc.

The question of passageways and the average length of haul must, of course, be given consideration. But the mere fact that the passageways appear difficult or crowded or the length of haul exceptionally short does not necessarily prohibit their use. As already stated, most of these machines can be operated wherever a hand truck is used. The steering arrangement is very flexible and the machines can be driven in either direction. This allows them to be driven into small corners, unloaded and backed out. Moreover, the handling of materials efficiently and profitably by electrics depends more upon the quantity and type of material handled than upon the distance over which it is to be carried.

Most manufacturers of the equipment maintain capable engineering staffs who can be called upon in difficult cases to explain the features of their apparatus and point out the features and saving of an installation. Machine shop officials who are contemplating changes or additions to their plant or equipment should avail themselves of this service.



An Electric Truck With a Crane Attachment Can Be Used for Lifting Heavy Materials Onto Machines.

OPPORTUNITY FOR ELECTRICAL MEN AT PRESENT.

At present the opportunities for promoting the installation of electric industrial trucks and tractors by electrical contractors and engineers and central-station men are particularly good. The majority of machine shop managers are now seriously considering all sorts of methods of increasing efficiency and reducing costs. Many of these methods involve changes of power, installations or additions. For example, increased lighting facilities are being required by a great many such shops. In considering such methods electrical men are usually consulted. In this capacity they are given an opportunity to study conditions in the shop and their suggestions are given great consideration.

For the central-station company the installation of electric trucks or tractors offers a most desirable load. The machines are generally charged at night when the rest of the plant is idle, which makes this an off-peak load and one for which central-station service offers many advantages. To the electrical engineer or contractor they offer an opportunity to perform a real service for the customer which will result in added profits for both. It is therefore important that these branches of the electrical industry should encourage the adoption of these machines wherever there is an opportunity to do so.

GERMAN ELECTRIC POWER NATIONALIZED.

A law nationalizing the electric power of the German Empire has been published by the government. Germany has over 4000 power establishments, and the splitting up of their activities is held to cause serious waste. The scheme is made imperative by the loss of the Saar coal fields and the obligation to supply coal to the Allies. The water power, which is mostly to be found in south Germany, is primarily to serve local industries, but an agreement will be made with those generating electricity from coal in central Germany. Power stations belonging to states and municipalities will not be disturbed, but the large plants belonging to private capital will be taken over and nationalized by the central government. The government will buy up shares, so that the present organizations can remain intact. The nationalized works are not to be considered as a source of revenue, as the government holds that cheap power for industry is more important than fiscal interests. The private capital in electrical power works in Germany is estimated at 1,000,000,000 marks and the use of electrical power in that country has increased from 4.43 billions of kilowatt-hours in 1907 to 22 billions in 1917.

ADDITIONAL GENERATING CAPACITY FOR NORTHERN STATES POWER CO.

The industrial growth of Minneapolis, St. Paul and southern Minnesota is brought into sharp relief by the action of Northern States Power Co. which will install an additional 40,000-hp. steam turbine unit in its Riverside station, Minneapolis. Within the past few weeks a new 40,000-hp. unit has been completed and placed in operation, but the electrical demands during the coming winter in the Twin City district will probably absorb this new capacity to the limit. No additions to the present Riverside station building will be necessary to house the generating and condensing equipment and boilers as ample reserve space was provided during the construction of 1918-19. This station in 1911 had a total capacity of 16,000 hp.; it will produce 116,000 hp. when the unit now authorized is completed in September, 1920. The 1918-19 addition has been referred to variously as a 33,000-hp. and 35,000-hp. unit. Under load it has tested out to 40,000-hp. capacity.

ROCHESTER SECTION, A. I. E. E., MEETS.

A meeting of the Rochester (N. Y.) Section, American Institute of Electrical Engineers, was held Oct. 24. E. B. Craft, assistant chief engineer, Western Electric Co., was the chief speaker, his subject being "Wartime Electrical Communications." He described some of the accomplishments and developments made by the army and navy in means of communication.

Central-Station Rates in Theory and Practice

Sixteenth Article — The Block Meter Rate and Its Combination with Other Rates—Customer Charges—Detailed Studies of Block Rates and Combinations — Average Charges with Meter Rates

By H. E. EISENMENGER

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This is the sixteenth article of this series, which began in the issue of July 12. In the first seven articles, constituting Part I, the cost of rendering electric service was discussed. The next six articles, Part II, dealt with the general policy to be followed in selection of a rate system. Part III began in the Oct. 11 issue and will include three more articles in the next few weeks treating with the various rate systems in more or less common use. The remaining articles of the series will appear weekly until the close of the present volume (Dec. 27). They will comprise Parts IV to VI and discuss rate analysis, accuracy of rates and rate regulation by commissions.

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

B. Rates Based on Energy Consumption Only.

2b. Methods for Applying Lower Average Kilowatt-hour Prices for Larger Consumers.

3. The Block Meter Rate.

SECTION 122. The block meter rate is the third method we can use to make the average kilowatt-hour charges lower for the larger energy consumer. The range of kilowatt-hours, beginning from zero, is here also divided into a number of ranges corresponding to the steps of the step meter rates. These ranges are in this case called "blocks." A certain unit charge per kilowatt-hour is made for all energy used within the first block, and that part of the energy which reaches into the second block is charged at a certain lower rate per kilowatt-hour. After the number of kilowatt-hours which are contained in the second block and are charged at that lower rate, the excess of energy over the second block is charged at a still lower rate until the third block is filled, etc. The difference from the step rate is that the charge connected with a certain block applies only to the kilowatt-hours within that block and not to those of the preceding blocks, whereas with the step rate the total bill is always calculated at one single rate.

Let us assume, for instance, that the first 100 kw-hr. be charged at 10 cents per kw-hr. and all excess energy over 100 kw-hr. at 5 cents per kw-hr. We have then in the range of 0 to 100 kw-hr. a straight meter rate of 10 cents per kw-hr.; for the consumers of 100 kw-hr. and more the charges (total bill) will be as given in the second column of the following table:

1. Kw-hr. consumed.	2 Charges. Block rate.	3 Charges. Straight meter rate, 5 cents per kw-hr.
100	$10.00	$5.00
101	10.05	5.05
102	10.10	5.10
103	10.15	5.15
.....etc.....		

Supposing now for a minute we had a straight meter rate of 5 cents per kw-hr. in the range both below and above 100 kw-hr., then the amounts will be those of column 3 of the above table. The block rate (column 2) is just $5 higher in every instance than the 5-cents-per-kw-hr. straight meter rate (column 3), regardless of the amount of energy consumed (provided, of course, that we remain within the second block). We can say, therefore: This block rate corresponds in the range of its second block to a combination of a straight 5-cent meter rate with a customer charge of $5. Where we have more than two blocks in the rate schedule the same general rule applies for all blocks: The block rate is equivalent to a combination of a straight meter rate with a customer charge. The customer charge is zero in the first block and increases with every successive block, whereas the energy charge decreases. This is more fully and more generally discussed in Insert XII, which also describes the resulting simplification of the method of figuring the bills of the block meter rate.

The block meter rate furnishes us with the first examples of what might be called a "concealed charge" or a "disguised charge." This means that one of the three "fundamental charges" (energy, demand, customer) is expressed by one or both of the other two charges so that it is not visible on the surface.

The block meter rate is the most frequently found

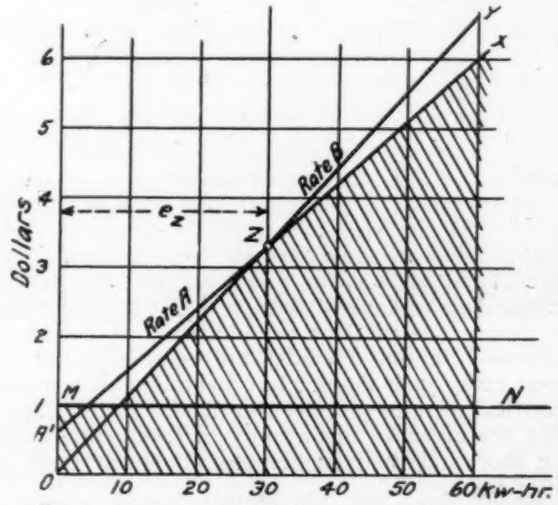


Fig. 7.—Stipulation of a Maximum Charge per Unit Results in the Equivalent of a Block Rate.

type of the pure meter rates. The number of the blocks does not go up as high as that of the steps in case of step rates; it ranges generally between two and eight, a larger number is a rare exception and no greater number of blocks than eleven[1] has been found in a very large number of schedules examined.

The block meter rate is also found combined with a minimum charge or a customer charge.

A block meter rate is sometimes briefly described by simply stating the successive kilowatt-hour charges and omitting for the sake of brevity any mention of the size of the blocks. Thus the Sacramento rate described and analyzed in Insert XII would be called "a 6-5-4-3-cent block meter rate." The same applies to step meter rates.

4. Combinations of Block Meter Rates With Step Meter Rates and Straight Meter Rates.

123. A block meter rate may be combined with a step meter rate in such a way that the lower energy consumptions are charged under the block meter system and anything above a certain amount of energy consumption is charged under the step meter system. The step rate may also contain one single step only, which means that it reduces to a straight meter rate. The order can also be reversed, which means that the step rate applies to the lower range of kilowatt-hours and the block rate to the higher one. (If we again consider the special case of the step rate comprising one step only, that is a straight meter rate, every plain block meter rate can be considered as a combination of a straight meter rate with a block meter rate, where the unit charge of the straight meter rate equals the unit charge of the first block of the block meter rate and where the straight meter rate extends over a portion, but not the whole, of the first block.)

These combinations do not occur frequently. Examples and their full discussion are given in Insert XIII.

5. Explicit Customer Charge.

124. A further method of doing away with or reducing the inequity which lies in the use of equal unit charges per kilowatt-hour to large and small consumers alike by the straight meter rate is to make an explicit customer charge in addition to either a straight meter rate[2] or a step rate[3] or a block rate[4]. This combination with a customer charge (especially if applied to the block system) can make the curve of actual charges follow very closely the curve of the theoretical charges as demonstrated in Section 4 of Insert XII, and is the most accurate pure meter rate, especially for small energy consumers. Notwithstanding this it is not very popular, probably because the public has not yet been educated to understand the equity of a fixed customer charge.

c. The Average Charges per Kilowatt-hour for Various Customers.

125. It has been shown (Section 117) that it is desirable to get lower average charges per kilowatt-hour for larger energy consumptions than for smaller ones. It will, therefore, be of interest to see how with the different systems discussed above (Sections 118-124) the average charges per kilowatt-hour vary as the amount of the energy consumption increases. This is fully discussed in Insert XIV, to which the reader is herewith referred.

Insert XII—Appendix to Section 122.

GRAPHICAL REPRESENTATION AND ANALYSIS OF THE BLOCK METER RATE.

1. A graphical representation of the block meter rate gives a most vivid insight into its nature. Let us take as an example the Retail Power schedule of Fort Wayne, Ind.:

[1] General Power Schedule, Salem, Mass.

[2] Battery Charging rate of Springfield, Ohio; customer charge 60 cents, energy charge 3 cents per kw-hr.

The General Lighting Rate of the New York and Queens Electric Light & Power Co. (customer charge 60 cents, energy charge 9 cents per kw-hr.) is only an apparent example of this combination because this rate contains a stipulation that the average rate per kilowatt-hour shall not exceed 11 cents per kw-hr. This makes the rate in effect a block rate. This example will be treated more fully here as it is typical for those schedules which make a stipulation that, no matter what is said elsewhere in the schedule, the average rate shall never be more than a certain specified amount per kilowatt-hour (compare Section 109).

Fig. 7 illustrates this rate. OA' is the customer charge of 60 cents and $A'\chi$ is the 9-cent-per-kw-hr. rate added to this customer charge. This combination will be called Rate A hereafter. Oy is the straight 11-cent-per-kw-hr. meter rate (Rate B) which limits the amounts of the bill under Rate A. The drawing shows that Rate B is lower than A for all points to the left of the intersection point Z between the two rates. This means Rate B will apply for all energy consumptions smaller than the energy consumption e_z belonging to that point Z and A will apply to all energy consumptions exceeding that amount; e_z can either be read off from the drawing Fig. 7 directly, or with greater accuracy and as a check it may be figured out arithmetically as follows: The amount of the bill for e_z kw-hr. under the Rate A is $60 + 9e_z$ and under Rate B it is $11e_z$. These two amounts are equal to each other because the point Z is situated on both rate curves and we have $60 + 9e_z = 11e_z$, from which $60 = 2e_z$ and $e_z = 30$ kw-hr. The combination of Rates A and B is therefore identical with a block rate as follows: 11 cents per kw-hr. for the first 30 kw-hr.; 9 cents per kw-hr. for the excess over 30 kw-hr.

In addition to this the rate states that a minimum charge will be made of $1 per month, which is represented by the straight line MN and applies to the equivalent block rate as well. The resulting curve is shaded in Fig. 7.

[3] General Lighting, York, Pa.: Customer charge 10 cents per month (this is the smallest customer charge the author could find in any rate) plus an energy charge of 10 cents per kw-hr. The bill is reduced by stepped quantity discounts as follows:

5% on bills from $1.01 to $ 2.00
20% on bills from $2.01 to $ 5.00
25% on bills from $5.01 to $10.00
etc.

These discounts change the apparent straight meter rate into a step meter rate as explained at the discussion of the step rate (Section 120).

[4] General Service Schedule of Lincoln, Neb.: Customer charge 40 cents per month plus an energy charge of

5 cents per kw-hr. for the first 10 kw-hr.
4 cents per kw-hr. for the next 30 kw-hr.
3.5 cents per kw-hr. for the next 460 kw-hr.
3 cents per kw-hr. for the excess over 500 kw-hr.

The General Lighting rate of Memphis, Tenn., is interesting in this connection: Customer Charge 30 cents per month plus an energy charge as follows:

6 cents per kw-hr. for the first 80 kw-hr.
5 cents per kw-hr. for the next 120 kw-hr.
4 cents per kw-hr. for the next 300 kw-hr.
3 cents per kw-hr. for the excess

} To be called Rate I.

Now the rate further provides that no customer's bill for service through one meter shall exceed 7.5 cents per kw-hr. on the average in any calendar year. If this clause could be read "on the average per month" we would have a case parallel to that of the New York & Queens Co. treated in the preceding footnote and the above rate would be simply reduced by that clause to a block rate as follows:

7.5 cents per kw-hr. for the first 20 kw-hr.
6 cents per kw-hr. for the next 60 kw-hr.
5 cents per kw-hr. for the next 120 kw-hr.
etc., as above.

} Rate II (monthly average)

As the clause applies, however, to the *yearly* average charge it is possible that the monthly bill of a certain customer exceeds this average charge of 7.5 cents per kw-hr., without reduction, for instance during the summer months, if his winter consumption is large enough to bring the yearly average charge below 7.5 cents per kw-hr. (It can easily be shown that this is the case if the average monthly consumption of the consumer over the whole year is greater than 20 kw-hr. See preceding footnote, third paragraph.) This means that the reduction of the bills by the maximum of the average energy charge takes place in more cases if the maximum energy charge applies to the monthly average than if it applies to the yearly average. The monthly average for the maximum energy charge is on the whole more favorable to the customers than the yearly average.

The maximum-average-charge clause is in a certain measure the opposite of the minimum-charge clause (see Sections 107 and 108). The former is a guarantee on the part of the *electric service company* that the average charge per kilowatt-hour over a certain period shall never be *greater* than a specified amount in cents per kilowatt-hour and the latter is a guarantee on the part of the *customer* that the payment for a certain period shall never be *smaller* than a specified amount in cents or dollars. That period may be a month or a year, and the choice of the larger period (the year) will have the opposite effect in the case of the maximum-average-charge clause than in case of the minimum-charge clause. Whereas, for instance, a yearly minimum charge of $12 has the tendency to make the customers' bills, as a whole, lower than a $1 monthly charge (see Section 107, first footnote), a maximum-average charge of, for instance, 10 cents per kw-hr. will tend to make the payments of the customers, as a whole, higher, if applied to the yearly average than if applied to the monthly average.

The first 50 kw-hr. are charged at 5 cents per kw-hr.
the next 100 kw-hr. are charged at 4 cents per kw-hr.
the excess over 150 kw-hr. at 2 cents per kw-hr.

We choose as horizontal axis the number of kilowatt-hours consumed and step off vertically corresponding the amounts of the customer's bill (Fig. A). A vertical line *I* drawn at the distance 50 kw-hr. from the vertical axis and another one *II* 100 kw-hr. further to the right will then give us the various blocks. In the first block we have a straight meter rate of 5 cents per kw-hr., which is represented by a straight line Ox, where x is, for instance, the point corresponding to 100 kw-hr. and $5. From the point *A*, where that line crosses the dividing line between the first and the second blocks, every additional kilowatt-hour is charged at 4 cents only and consequently we have to proceed from this point along a line with a smaller angle of elevation, corresponding to 4 cents per kw-hr. We can get this angle by joining *O* with, for instance, the point *y* (100 kw-hr., $4). Drawing a parallel to this line Oy through *A* will give us the amount of the bills in the second block, line *AB*. It is evident, if we produce this line backwards towards A_o that the rate in the second block corresponds to a straight 4-cent meter rate increased by a constant amount OA_o, that is by a customer

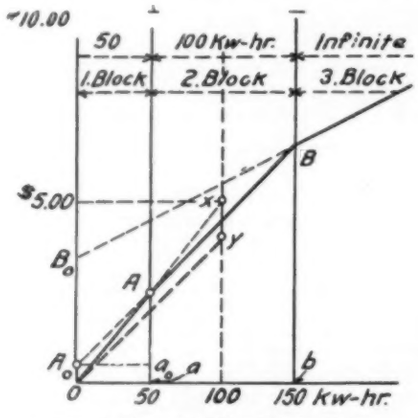


Fig. A (Insert XII).—Block Rate.

charge. It is obvious from the drawing that with every successive block this equivalent customer charge increases as the kw-hr. charge of the block rate decreases. It is also evident that the kilowatt-hour charge of the straight meter component of the equivalent rate is identical with the kilowatt-hour charge of the block meter rate in the respective block.

2. The numerical value of the equivalent customer charge in a given case can be found either by measuring the values OA_o, OB_o, etc., in the chart, or by purely arithmetical operations in the following way. The customer charge of the second block in Fig. A is OA_o, which obviously equals aa_o. Now $aa_o = aA - a_oA =$ (50 kw-hr. × 5 c/kw-hr.) — (50 kw-hr. × 4 c/kw-hr.) = 50 cents. Similarly we get the customer charge for the third block as: (50 kw-hr. × 5 c/kw-hr.) + (100 kw-hr. × 4 c/kw-hr.) — (150 kw-hr. × 2 c/kw-hr.) = 350 cents or $3.50.

In general, to find the equivalent customer charge of the n^{th} block, figure the products of each preceding range in kilowatt-hours by the energy charge in the respective range and from the sum of all these products subtract the product of the sum of all ranges in kilowatt-hours, preceding the n^{th} range, in kilowatt-hours, by the kilowatt-hour charge of the n^{th} range.

An example will make this clear. Take, for instance, the Commercial Light rate in Sacramento, which is a block meter rate charging:

6 cents per kilowatt-hour for the first 50 kw-hr.
5 cents per kilowatt-hour for the next 400 kw-hr.
4 cents per kilowatt-hour for the next 600 kw-hr.
3 cents per kilowatt-hour for the excess over 1050 kw-hr.

How large is the equivalent customer charge in the 4^{th} block? Answer: (6 × 50) + (5 × 400) + (4 × 600) — 3(50 + 400 + 600) = 1550 cents or $15.50. We can thus figure the bill of any customer with more than 1050 kw-hr. simply as $15.50 plus 3 times the total kilowatt-hour consumption of that customer. For instance, if the customer has used 2000 kw-hr. his bill will be $15.50 + (3 × 2000 cents) = $75.50.

This method is a simplification of the obvious method of computing the bills by figuring out the charge for the energy in each block and adding them, as this method does away with the subtraction of 1050 from 2000.

We can therefore make up a little table as follows:

Range in kw-hr.	0 — 50	51 — 450	451 — 1050	1051 and over
Customer charge	$0	$0.50	$5.00	$15.50
Energy charge (cts. per kw-hr.)	.06	.05	.04	.03

From this table we can calculate any bill with not more than one multiplication and one summation, without any subtraction.

Algebraic Analysis of the Block Meter Rate.

3. An algebraical investigation for those readers who are familiar with algebra will supplement this. Calling c_1 the energy charge per kilowatt-hour in the first block, that is from 0 to e_1 kw-hr., c_2 the energy charge per kilowatt-hour in the second block, that is between e_1 and e_2 kw-hr., etc., we get the amount of the bill in the first block (less than e_1 kw-hr.) as

$$a_1 = c_1 e \qquad (1)$$

where e is the number of kilowatt-hours consumed. If the customer's energy consumption e reaches into the second block we have to pay for the first e_1 kilowatt-hours at the rate of c_1 cents per kw-hr. and for the balance of $(e - e_1)$ kw-hr. at the rate of c_2 cents per kw-hr., so that the whole bill a_2 becomes

$$a_2 = c_1 e_1 + c_2 (e - e_1)$$
$$= (c_1 - c_2)\, e_1 + c_2 e \qquad (2)$$

The constant term $(c_1 - c_2) e_1$ is obviously the customer charge and the part which is proportional to e is a straight meter rate. The unit charge of that straight meter rate is the factor by which e is to be multiplied, that is c_2.

If the energy consumption e becomes greater than $(e_1 + e_2)$ and therefore reaches into the third block we have first to pay for $(e_1 + e_2)$ kw-hr. as per equation (2), that is $(c_1 - c_2)\, e_1 + c_2 (e_1 + e_2)$ and for the remainder of $e - e_1 - e_2$ we have to pay at the rate of c_3 cents per kw-hr., in other words

$$a_3 = (c_1 - c_2) e_1 + c_2 (e_1 + e_2) + c_3 (e - e_1 - e_2)$$
$$= (c_1 - c_3) e_1 + (c_2 - c_3) e_2 + c_3 e$$

In the same manner we get

$$a_4 = (c_1 - c_4) e_1 + (c_2 - c_4) e_2 + (c_3 - c_4) e_3 + c_4 e$$

. . . . etc. . . . .

The terms in brackets are constant and represent always the customer charge in every one of these equations, whereas the co-efficient of e (that is c_1, c_2, c_3, . . . etc.), is the energy charge of the straight meter rate component of the equivalent combinations of rates. If we write this in the form

$$a_4 = c_1 e_1 + c_2 e_2 + c_3 e_3 - (e_1 + e_2 + e_3)\, c_4 + c_4 e$$

we see that the result is the same as the one obtained above for a special numerical case. The results can also easily be verified graphically.

4. We see from the figures of Insert XI on the one hand, and from a comparison of Fig. A of this Insert with Fig. A of Insert X on the other hand, that the block meter rate follows the theoretical requirements of the pure meter rate more closely than the step meter rate. Especially if we add an explicit customer charge to the block meter rate[1] (which would mean that the duct of straight lines of Fig. A of this Insert will have to be raised parallel to itself by the amount of the customer charge) we see that we can with a very limited number of blocks approach the theoretical curve to any degree of approximation which is desirable in practice.

Insert XIII — Appendix to Section 123.

COMBINATIONS OF BLOCK METER RATES WITH STRAIGHT METER RATES AND STEP METER RATES.

These combinations do not occur frequently. An example for the combination of a block meter rate with a straight meter rate is the General Lighting schedule of Cambridge, Mass. This rate charges

9 cents per kw-hr. (net) for the first 500 kw-hr.
8 cents per kw-hr. (net) for the next 500 kw-hr.
7 cents per kw-hr. (net) for the next 1094 kw-hr.
3.875 cents per kw-hr. (net) for the next 2856 kw-hr.
5.5 cents per kw-hr. (net) for 4950 kw-hr. or over.

The last line of this table is a straight meter rate. The price per kilowatt-hour in this rate is chosen in such a way that we arrive at the same bill for the limiting number (4950 kw-hr.) of kilowatt-hours, whether we figure it according to the last, or to the last but one line. The curve of the rate (see also Insert XII) is shown in Fig. A.

The Municipal Wholesale Power rate of Fort Wayne, Ind., is a combination of a block rate in the lower ranges of energy consumption and a straight meter rate in the higher-

[1] See Section 124 of the main text.

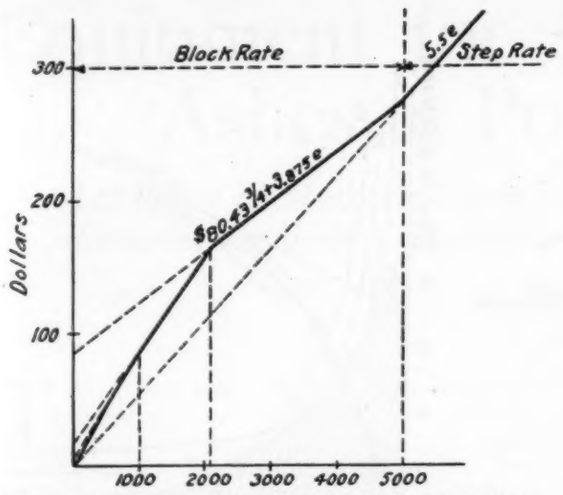


Fig. A (Insert XIII).—Block Rate Followed by Step Rate.

ones. Steps are worked into the rate by discounts which extend back into the range of the block rate as follows:

The rate charges: 3 cents per kw-hr. for the first 350 kw-hr.
2 cents per kw-hr. for the excess over 350 kw-hr.
If over 5000 kw-hr., 2 cents per kw-hr. for all the energy consumption.

Quantity discounts: 10% on bill of $ 25
15% on bill of $ 50
20% on bill of $ 75
25% on bill of $100
30% on bill of $150

Fig. B shows the curve of this rate and Fig. C that of the Retail Power rate of New Britain, Conn., which is the reverse of the rate just discussed, inasmuch as it contains a step rate in the lower, and a block rate in the higher ranges. The last one of the 15 steps charges 2.5 cents per kw-hr. in the range from 4000 to 5000 kw-hr. The block rate begins nominally at 5000 kw-hr., charging in the first block (5000-10,000 kw-hr.) the same unit rate of 2.5 cents per kw-hr. as the last step of the step rate. Therefore the curve is an unbroken straight line from 4000 to 10,000 kw-hr. and we might choose any point between 4000 and 10,000 kw-hr. as the end of the step rate and the beginning of the block rate. The block rate has very large blocks (5000 kw-hr. each) and the difference between the unit charges of successive blocks is only 0.1 cent, so that the curve of the block rate is very nearly an unbroken straight line.

Insert XIV — Appendix to Section 125.

AVERAGE CHARGES PER KILOWATT-HOUR WITH THE PURE METER RATES.

The only graphical representation of pure meter rates

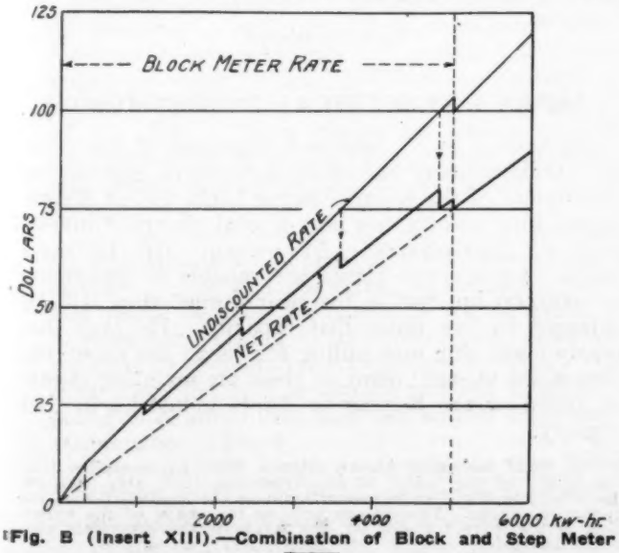


Fig. B (Insert XIII).—Combination of Block and Step Meter Rates.

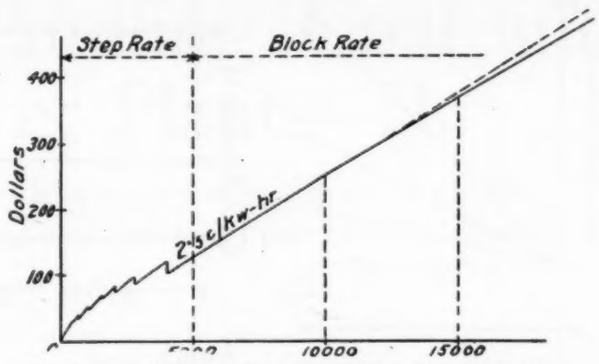


Fig. C (Insert XIII).—Step Rate Followed by Block Rate.

used so far was that of showing the amount of the customer's bill with varying energy consumptions (Inserts X - XIII and Figs. 4 - 6 of the main text). In this method of representation we get ducts of straight lines for the block and the step meter rate, and each of these straight lines is the equivalent of a combination of a straight meter rate with a customer charge. The energy charge of the schedule in cents per kilowatt-hour is given by the angle of elevation ϵ of the respective straight line from the horizontal[1]. (Fig. A) The larger the energy charge, the steeper the line will be. This energy charge can also be defined as the increment cost (to the consumer) per kilowatt-hour, that is, the price of every additional kilowatt-hour and must not be confounded with the average price per kilowatt-hour. This average price is given by the total bill divided by the number of kilowatt-hours consumed. If we connect a point P of the rate curve (duct of straight lines) with the origin O (Fig. A) the angle α which this connection line includes with the horizontal is a measure of the average price per kilowatt-hour. The steeper that angle is the higher is the average price[2].

We can thus by a glance at the rate curve easily form an idea how large the average price per kilowatt-hour is for every number of kilowatt-hours and how it varies. We need only estimate the variation of the angle α.

In many cases we find employed curves of the average price per kilowatt-hour rather than of the total bill. The curve of the total bill is, however, not only more instructive as regards the nature of the rate, but generally also simpler, because it almost always consists of straight lines only. Nevertheless, since, in spite of this, the curve showing the average price per kilowatt-hour is still frequently being employed, it will be shown in the following how the average price per kilowatt-hour varies in case of the block rate and of the step meter rate.

It has been shown that both the block rate and the step meter rate are composed of the two elements of the straight meter charge and the customer charge, and no other elements. These two elementary charges will be treated first and their combination afterwards. The total bill under a straight meter charge is represented by Fig. B_a. The average price per kw-hr. is, of course, constant. It is therefore represented by a straight horizontal line (Fig. B_b) the height of which above the axis is given by the kilowatt-hour charge. (The full lines in Figs. B_a and B_b belong to one another, likewise the dotted lines and the dash-and-dot lines.) In the other one of the two elementary rates, consisting of a pure customer charge, the curve which represents the customer's bill is a straight horizontal line (Fig. C_a), the height of which above the horizontal axis corresponds to the amount of the customer charge in dollars or cents. The curve for the average charge per kilowatt-hour is less simple (Fig. C_b).

[1] Speaking accurately and in mathematical terms: By the tan ϵ.

[2] Speaking accurately and in mathematical terms: The average price is given by tan α.

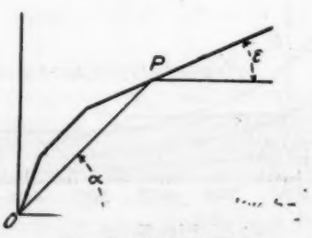
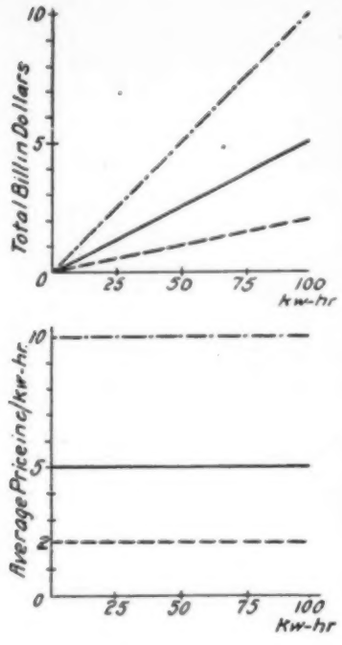
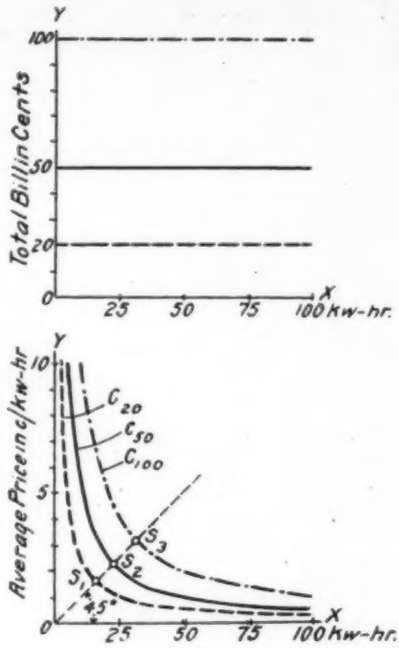


Fig. A (Insert XIV).



Figs. Ba and Bb.



Figs. Ca and Cb.

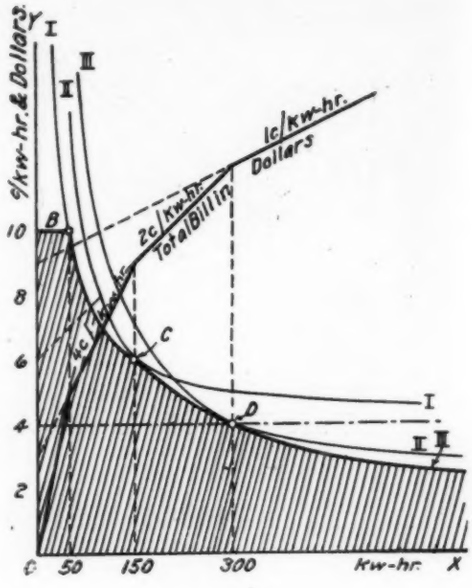


Fig. D.

If the bill is constant, for instance 50 cents (full line) the average price per kilowatt-hour will be

10 cents per kw-hr., if energy consumption is 5 kw-hr.
5 cents per kw-hr., if energy consumption is 10 kw-hr.
2 cents per kw-hr., if energy consumption is 25 kw-hr.
1 cent per kw-hr., if energy consumption is 50 kw-hr.

The curve which results from plotting these values is shown as curve C_{50} in Fig. Cb. The other curves for $1 and for 20 cents customer charge are also shown in the same figure. All these curves are equilateral hyperbolas with asymptotes OX and OY; this means that the curve steadily straightens out from O towards X and towards Y and it approaches the axes OX and OY more and more the further out we extend it, but it never touches them.

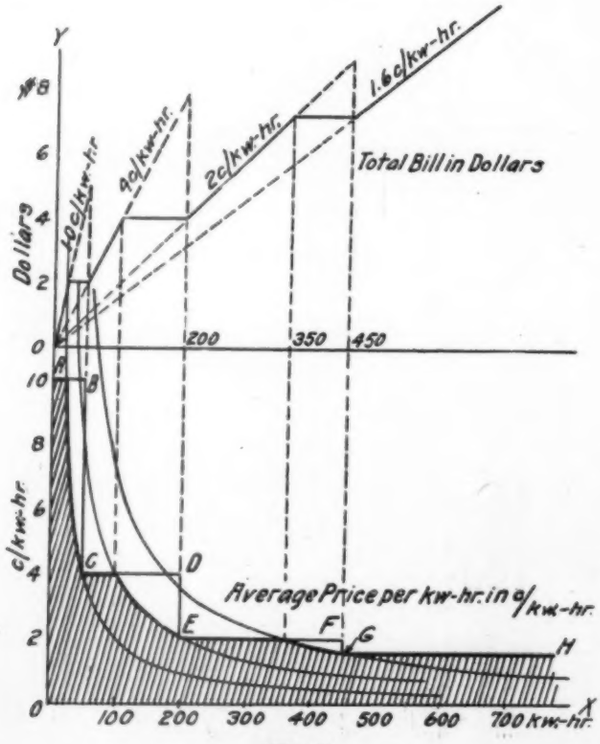


Fig. E.

If we now add these two elements, the straight meter charge and the customer charge, as in the block rate, the average-price curve will be a summation of the respective curves of the two elements, Fig. Bb and Cb, this means we will get the hyperbola in Fig. Cb, but the horizontal line of Fig. Bb will express itself by raising the hyperbola into a higher position. We thus get the curve of the average price per kilowatt-hour for a block rate (Fig. D, shaded area). It consists in the first range of the block rate of a horizontal straight line as the block rate itself in that range is nothing but a straight meter rate. In the following ranges a series of hyperbolas will result (*I, II, III*), one for each range. The axis of ordinates is the common vertical asymptote for them all and the respective horizontal asymptotes are located at distances above the horizontal axis which are given by the energy charge in the respective block. Thus, for instance, the horizontal asymptote of the hyperbola *I* (dash-and-dot line) is located at 4 cents per kw-hr. above the axis OX[2].

As regards the unmodified step rate, the average charge per kilowatt-hour is evidently indicated by the curve (duct) *ABCDEFGH* (Fig. E) resembling steps on a flight of stairs (hence probably the name "step rate"). Where we modify the step rate by the requirement that no greater total charge shall be made for a smaller number of kilowatt-hours than for a larger one the corners at *B*, *D* and *F* are cut off by hyperbolas, the asymptotes of which are always given by the axes OX and OY, as will be easily understood from the foregoing.

(To be continued.)

JAPAN'S ELECTRICAL INVESTMENT.

According to Y. Ishikawa, manager of the commercial department and chief engineer of engineering department of the Kyoto Electric Light Co. of Kyoto, Japan, that country has now a total electrical investment of $500,000,000. At present Mr. Ishikawa states, hydroelectric plants are capable of producing a 1,000,000 hp. but in the near future they will be enlarged to five times that capacity. He says that nearly every ship now sailing for Japan has about 150 Americans aboard; many of them are investing capital in Japan or are helping to direct industries in that country.

[2]It could be easily shown with a little mathematics that the length of the "axis" of the hyperbola (OS_1, OS_2, OS_3, respectively, in Fig. Cb) is proportional to the square root of the customer charge. This means that as the shape of the hyperbola is the more rounded off, the larger is the equivalent customer charge.

Equipment for Handling Coal and Ashes in Power Plants—II.

Influence of Methods Upon Plant Operation—Classification of Mechanical Methods of Handling Coal and Ashes—Power Calculations

By ROBERT JUNE

Mechanical Engineer.

THE power plant owner, who is considering the installation of mechanical coal and ash handling systems, is confronted by a number of fundamental problems which must all be solved correctly if he is to make a satisfactory decision. If the solutions require time and study, he will do well to refuse to be hurried in his investigations.

Prominent among the questions to be answered, are the following:

(a) What type, or types, of equipment are best adapted for the conditions in the industrial plant under consideration?

(b) Shall the coal and ash handling systems be divorced?

(c) Granted that questions (a) and (b) are correctly answered, will the equipment chosen meet the requirements of the $O\ M\ I < H$ formula; that is, will the operating costs O, which include power, labor to operate, oil, etc., plus the maintenance costs, M, which include repairs of any nature, labor to make repairs, depreciation, etc., plus interest, I, on total money invested, which must include not only equipment and parts purchased from manufacturer, but cost of labor to install, cost of foundations, bunkers, and other changes, be less than the cost of doing the same work by hand, H?

In order to arrive at some understanding of the factors entering into the first of these three problems, a brief survey of the different types of coal and ash handling equipment appeared last month. Continuing this description.

Apron Conveyors.

The apron conveyor was developed with the idea of obtaining a self-supporting continuous belt for handling heavy material. It consists of a double strand of roller chains, on which are mounted steel plates, the width of which corresponds to the pitch of the chain. These plates are beaded or curved over each other to form a closed joint. The sides are also made overlapping so as to produce a closed trough.

Apron conveyors are commonly used for conveying coal from track hoppers to the main conveyor and elevator. Only end discharge, of course, is possible, and thirty degrees inclination is the practical limit in elevation. Owing to its construction, this type of conveyor is comparatively expensive to install. However, since the load is carried and not dragged, less power is required than with the scraper type, and the maintenance is lower.

In estimating power requirements, the formula previously given for flight conveyors may be used with a reduction of 10% in the final figures.

In the pan conveyor, the flights are omitted, and the trough itself is made in sections and mounted on the chains. By this change the material is carried, with consequent reduction in wear.

This type of conveyor is used where pans, deeper than those of an apron conveyor, are required, as on inclines too flat for elevators and too steep for efficient operation of flight, or apron conveyors. The usual speed is 30 to 50 ft. per min. when supported by self-oiling roller wheels, the power consumption is but little above theoretical load requirements. For purposes of estimate, the power may also be assumed as 10% less than that of the formula previously given.

In passing, it should be noted that on account of the abrasive character of the materials, the employment of pan and apron conveyors for ashes is apt to result in excessively high maintenance costs.

V-Bucket Conveyors.

In this type the buckets are rigidly fastened to the conveyor chain, with the result that on the vertical runs, the material is lifted, whereas on horizontal runs, it is dragged through the trough ahead of the bucket.

V-buckets are one of the less expensive forms of chain conveyors, and should be given consideration in the smaller power plants, while not as popular as in the past there are a goodly number of fairly representative medium sized plants that employ them to good advantage.

Power requirements may be approximated from the following equation, supplied by courtesy of Professor Gebhart.

$$HP = \frac{AWL^1S}{1000} + \frac{BL_1T}{1000} + \frac{TH}{1000} + \frac{1}{2}x^1$$

in which

A,B = constants as in Table II.
W = weight of conveyor per ft. of run, lbs.
S = speed of conveyor, ft. per min.
T = capacity of conveyor, tons per hr. (Note, figure 50 lbs. coal per cu. ft. and 40 lbs. of ashes.)
L^1 = horizontal length of conveyor, ft.
L_1 = total horizontal length traversed by the loaded bucket, ft.
H = total vertical traverse, ft.
x^1 = number of 90° turns to the conveyor.

Pivoted Bucket Conveyors.

This is the most popular form of chain conveyor for both medium and large sized power plants. The pivoted bucket carrier is composed of a continuous series of malleable iron buckets, pivoted between two strands of roller chain, of approximately 18-in. pitch. There are several different forms of this car-

rier on the market. The differences in these carriers are principally in the method used to empty the buckets at the discharge point, the method used to close the gaps between adjacent buckets to prevent spillage, and the method of driving the conveyor. In one form of carrier, the buckets are made with an overlapping lip, in a second, a roller is introduced between adjacent buckets, etc. The roller chain is carried and guided by a track composed of standard tee-rails. This rail is mounted on special cast-iron rail chairs, both horizontal and vertical runs. The buckets can be dumped at any desired point by means of an adjustable dump mechanism, which may be set wherever desired.

As the buckets are pivoted and always remain in the horizontal position, except when being dumped, this conveyor can be used for handling material both horizontally and vertically. The pivoted bucket carrier

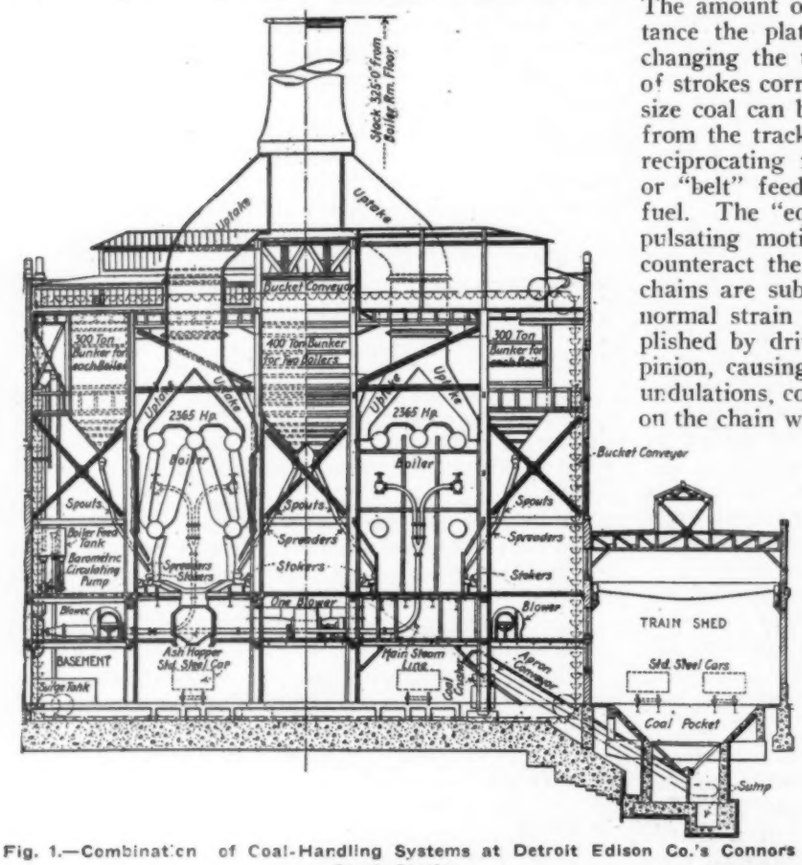


Fig. 1.—Combination of Coal-Handling Systems at Detroit Edison Co.'s Connors Creek Station.

is generally installed in power plants, so arranged as to handle both coal and ashes in the same carrier. It is installed in the form of a loop, running through the basement up one end of the boiler house, over the top of the overhead coal storage bunkers and down the other end to the basement. Coal is discharged from the receiving track through a track hopper, feeder and crusher, into the pivoted carrier in the basement, and carried up to the overhead storage bunkers. Ashes are dropped from the ash pits into the horizontal run in the basement and carried up to an overhead bunker for storage.

Pivoted bucket conveyors possess the following advantages:

1. The material is carried and the buckets are supported by rollers. Destructive friction and injury to the material itself is therefore eliminated, and the power required for operation reduced to the minimum.

2. The ability of the one machine to elevate and convey avoids transfers, which are always troublesome, take up valuable space, and necessitate deep pits. The driving connections are also correspondingly simplified.

3. The material is readily discharged at any desired point.

4. The operation is comparatively silent, and as they are run at slow speed, there is little vibration.

One type used is the Peck Carrier pivoted bucket conveyor, as manufactured by the Link Belt Co. Coal is fed to the crusher by the "reciprocating feeder" which is usually placed directly under the track hopper. The feeder consists of a heavy steel plate, mounted on rollers, and having a reciprocating movement, effected by a crank mechanism from the carrier. The amount of coal delivered depends upon the distance the plate moves, and this can be varied by changing the throw of the eccentrics. The number of strokes corresponds to the number of buckets. Any size coal can be readily handled. When the distance from the track hopper to carrier is so great that the reciprocating feeder is not practicable, a continuous or "belt" feeder is used to supply the crusher with fuel. The "equalizing gear" is designed to impart a pulsating motion to the driving wheel, which will counteract the natural pulsation to which long pitch chains are subject, producing violent increase of the normal strain at frequent intervals. This is accomplished by driving the spur wheel with an eccentric pinion, causing the pitch line to describe a series of undulations, corresponding to the number of sprockets on the chain wheel.

In Fig. 1 is illustrated the use of a combination of conveying systems at the Connors Creek Plant of the Detroit Edison Co. The coal enters the train shed in drop-bottom cars, usually of the 50-ton size. The cars dump into the hopper under the tracks in the train or coal shed, there being one hopper for each unit of one turbine and two boilers. A motor driven variable speed flight conveyor with a capacity of 120 tons per hr. receives coal from the hopper, carries it up a rather sharp incline and discharges it into a four-roll motor driven crusher of similar capacity. This crusher breaks from 18-in. cube to 100%, through a 1¾-in. ring.

The crusher discharges into a motor driven variable speed hopper bucket conveyor, with 30 by 36-in. buckets. This conveyor forms an endless chain which entirely encloses the section of the boiler house. It carries the coal up on the side nearest the coal shed and discharges it into any one of the three coal bunkers which serve the two boilers of one unit.

The hopper, pan conveyors, crushers and bucket conveyors for each unit of one turbine and two boilers, are so located that they can deliver through chutes to one adjacent range of bunkers, serving thus as a spare for that range.

An estimate of the power required for any proposed installation of pivoted bucket conveyors can be obtained by reference to the formula given for V-bucket conveyors, subtracting 10% from final figures.

(To be continued.)

COURSE IN COMBUSTION ENGINEERING TO PROMOTE FUEL CONSERVATION.

Central Stations and Others Given Chance to Reduce Fuel Consumption Through Education.

Coal may never be cheap again. In any case it will be a long time before such is the case; and meanwhile every influence is exerting pressure toward fuel-saving measures.

Every user of fuel, of coal, oil and gas, can help save it. Saving it, as understood at the present time means minimizing waste. Minimizing waste in turn, means eliminating the preventable losses and therefore needless losses, and reducing to the lowest possible value the unpreventable losses. The first thing to do toward this end of fuel saving, is, obviously, to understand the characteristics and properties of fuel and the chemistry of burning it. The next requirement is to understand the art or science of applying the heat obtained by the chemical reaction of combustion, that the heat so obtained may be most fully utilized.

In other words, knowledge of combustion and its applications and a thorough understanding of the principles involved, are the requirements for conserving fuel by using it most usefully. And everyone concerned in the use of fuel can help conserve it by possessing a knowledge of fuel. Some can do more than others toward this end, of course. Executives, and power-plant designers, plant owners and managers are morally responsible for the fuel consumed in their plants. Combustion and efficiency engineers, superintendents, watch engineers and firemen are the ones most closely and directly instrumental in saving fuel. To all alike, knowledge is power.

Keeping Up the Good Work of the U. S. Fuel Administration.

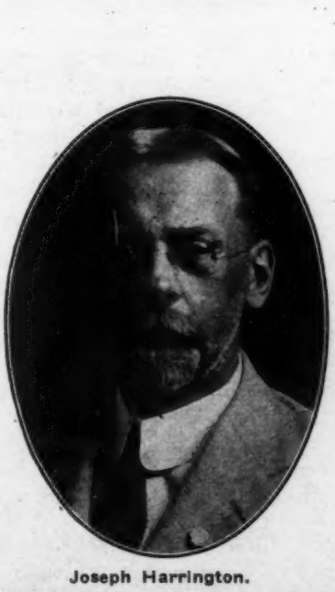
In the winter of 1917, the fuel situation necessitated heroic steps being taken by the U. S. Fuel Administration to reduce fuel consumption, to relieve congested and overtaxed railroads and keep rate of consumption down to rate of production. Everything was done to strike at the root of waste of fuel. The less necessary plants were shut down. Assistance was given to help improve plants that were wasteful through ignorance and poor maintenance. But perhaps the greatest saving in fuel was brought about through education and inspiration. Moreover, this was the most permanent way of saving because forced shutdowns could be only temporary whereas education is permanent in effect.

Education through publicity in newspapers, bulletins and letters was the master stroke of the Fuel Administration toward fuel saving. As an example, the administrative engineer for Illinois, Joseph Harrington, sent out personal letters of instruction to every one of the 10,000 power plants in Illinois. These letters were simply, tersely and interestingly written, and to the point. Each letter covered some specific subject. Each letter was studied hungrily by plant owners and operators alike—for each needed desperately to save fuel.

The startling results obtained in the way of power-plant betterment and the manner in which request was made from all quarters for these letters and more letters brought realization in an amazing manner as to the need these letters of instruction were filling. Instruction by mail thus aided in fuel conservation.

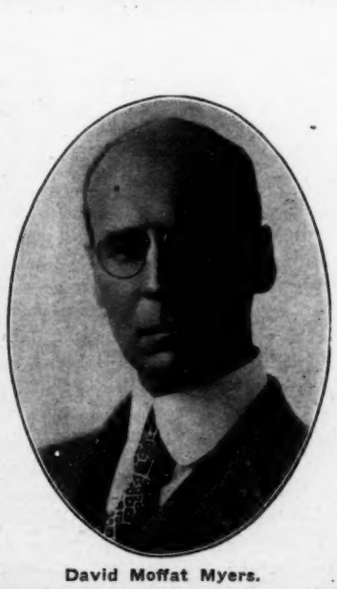
When the armistice came, the purpose for which the Fuel Administration had been formed ceased to exist, legally. The intensive methods previously employed could no longer be continued. On the other hand, while the war's demands had ceased, the demands of peace are just as real and just as exacting, with the difference that the requirements of peace are permanent while those of war were transient. With no prospect of fuel going down in price—all conditions favor rising prices—and with a better understanding gained of what a valuable asset are our natural resources, sufficient incentives and economic factors combine to make it worth while, nay imperative, to continue to save fuel.

Those closest in touch with the fuel situation, and the ways of consuming it, wasting it and saving it, obviously would know most about the best way to tackle the pressing problem of making true conservation practical and effective. And no one better than they can appreciate the urgent need for saving fuel now; and of making fuel saving permanent. This means that the men who did so much to save fuel when the insatiate demands of war made saving vital, could still do what they did before to save fuel.



Joseph Harrington.

Joseph W. Hays.



David Moffat Myers.

And now a few of the men who made the Fuel Administration what it was, men whose work and skill enabled them to stand out in those days when it was said that coal would win the war, have tackled this problem of making fuel conservation permanent. These men have adhered to the policy that brought success before. They have found a way to keep up many of the tactics that have been proven successful, namely, distribute knowledge and instruction in combustion and the consumption and utilization of fuel. The course in combustion engineering has been named after its author, Joseph W. Hays, known to ELECTRICAL REVIEW readers for his famed little book "Combustion Efficiency" and his numerous articles on combustion problems. Those collaborating and co-operating with him upon the educational staff are David Moffat Myers, Joseph Harrington, Prof. S. W. Parr, Fred R. Low, A. L. Rice.

Each of these men has placed his skill, his knowledge and reputation upon this course on combustion engineering without charge. Each has devoted his time and effort toward making possible the education of thousands most closely concerned with the purchase and use of fuel, without payment. Each states that he considers his part in this educational movement, as his contribution to the cause of fuel conservation. Each looks to the results obtained—fuel conserved through knowledge in its use—as his full reward.

It is but natural that those best appreciating the urgent need for fuel conservation should have taken the initiative in this movement to save fuel by knowing how to use it.

Each has co-operated not for financial gain but because they have seen the vital need for some active steps being taken to save coal now. The standing of these men, each a master of his subject, should be a guarantee that the subject of combustion is treated in an effective manner.

COURSE IN COMBUSTION ENGINEERING.

The course is divided into twelve sections. Each section must be mastered before the subsequent lessons or sections are tackled. Moreover it is necessary to attain a marking of 75% in any section before passing on to the next lesson. The course covers its subject gradually, at first by taking up the subject in a broad way. Gradually the matter becomes more and more specialized, the later lessons each having a special subjective.

A better idea can be obtained by naming the various lessons in the order in which they will be taken up by the student. The first is an introduction on the history of steam and economical steam production. The second deals with boiler furnaces and general rules of practice, a discussion of the plain furnace and its many modifications and stoker types. Third is a lesson embracing a general discussion on drafts, natural and artificial. The fourth lesson takes up natural fuels and all about them, including methods of coal, oil and water analysis. Physics and the chemistry of combustion and combustion analysis is covered in the fifth lesson. In the sixth, operation of boiler plants is taken up; also applied combustion analysis. Smokeless combustion and applied combustion analysis occupies lesson seven. The eighth lesson deals with testing of boiler and furnace and applied combustion analysis. In the ninth lesson is taken up in detail such important specific matters not fully covered in preceding lessons. Industrial gases and the gas producer and applied combustion is dealt with in the tenth lesson. In the eleventh lesson, gas and oil engines and applied combustion analysis for this phase of the application is covered. In the twelfth lesson the work of the combustion engineer, and the keeping of charts and cost data are fully covered. The above is only a bare outline of the course, but suffices to show the length and thoroughness to which the author has gone.

The aim of the course is to equip men concerned with the application and use of fuel with the knowledge of how best to use it. Only when this obtains will the interests of fuel conservation be best served. Several interesting features of the course assist toward this end.

Everything has been done to make combustion attain the prominence and encouragement it deserves. Graduates and students may, if they choose, register for positions. In this way openings and positions may be filled and employers gotten quickly into touch with good men, graduates of combustion engineering. Skilled combustion engineers thus are offered every opportunity for improving themselves; plant owners of obtaining men that can be trusted to use up their fuel, safe in the knowledge that they come to them meeting a definite standard of fitness. The choice of a combustion or efficiency engineer need no longer be a hit or miss process.

As a further incentive, provision is made, when desired, to notify employers from time to time as progress in the course is made. In this way remuneration or position may keep pace with ability, a personal interest between employer and employe develops and pay tends to go up with worth. By taking such a course, a graduate is able to know his own worth based upon a standard rating and can thus capitalize his training equitably.

The course, when completed, will enable anyone to have acquired a very complete and practical training in the combustion and application of fuels. The course, so far as we can ascertain, is the only one in existence that deals exclusively with combustion engineering. The diploma won upon graduation is the only standard of merit awarded at the present time in this important branch of the engineering profession. The conclusion is obvious and inescapable. It is inevitable that such a course must prove a prominently vital factor in furthering fuel conservation by creating men who are vastly more valuable to themselves and to the country. The greater the number that take up this course, the greater will be the fuel saving, and the greater the gratitude of the country and of everyone to those that have fitted themselves to consume a national resource, and to those who have enabled them to do so from patriotic motives.

Knowledge is power. Power brings ability to do. And never was the need for fuel saving greater than it is today. The course in instruction on combustion engineering fathered by Joseph Hays and his collaborators is a radical and most hopeful forward step taken toward reducing the colossal and needless waste of three of our most valuable natural resources, coal, oil and gas. To save fuel by teaching its use seems to be the soundest method of conservation yet advanced. Education has done more for the advancement of the race, for the uplift of nations and formation of habit than all legislation, threat and punishment combined. And in education rests the only hope for fuel conservation. Interested readers should address the Hays School of Combustion, Chicago

Editorial Comment

The Illuminating Engineering Society

IF evidence were needed of the distinctive need for the Illuminating Engineering Society and the soundness of its organization, it was furnished by the thirteenth annual convention held in Chicago this week. A somewhat extended report of this gathering is given on other pages of this issue. The large and very representative nature of the attendance and the eagerness with which the papers and addresses were absorbed and discussed showed conclusively that the field of illumination is a very broad and attractive one and that the society is the only forum where its problems can be discussed on an unbiased basis, regardless of the source of light and the commercial origin of the lighting equipment. For over thirteen years the society has held steadfast to fair and scientific consideration of lighting questions free from commercialism. Its success in this field has stimulated the formation of similar societies in three other countries: Great Britain, Germany and Japan. Members of two of these societies addressed the Chicago convention.

At times it has been advocated in this country that the work of the society could readily be taken over by the National Electric Light Association and the similar gas organization. These latter associations, however, have as their main function the discussion of public utility problems, among which is the extension of the sale of their respective services. It has been shown that the Illuminating Engineering Society is not interested in selling more light but in urging better lighting practice. Of course, this involves in many cases use of more artificial light, but the distinction is a vital one that we are glad to see is being recognized.

The incoming administration of the society under President S. E. Doane has splendid plans for extending its educational work and co-operation with other organizations concerned with lighting. This is no reason why these broadened activities may not be undertaken with profit to all if they are conducted on the broad plane of freedom from commercialism so well carried out by the society in these many years.

Combustion Engineering

CONSERVATION of fuel, and of coal especially, is a pertinent matter at this time because of the threatened strike of the bituminous coal miners at a season of the year when the demand and need for coal is approaching its height. However, the urgent need for saving fuel—some of our most precious buried treasure—is a pressing matter at all seasons. It is with us always.

The higher cost of all fuels and the threatened shortage of coal brings the problem of coal saving very close to most of us. But the gradual diminishing supply, while one that appears to be less near, is, nevertheless, one that will affect us all commercially and economically some day, not by extinction, of course, but by increased costs due to having to go deeper into the ground for it and because of other causes contributing to higher costs. Fuel in some form or other enters into so many phases of our industrial, commercial and economic life that it is one of the vital factors in our lives today. Fuel conservation is, therefore, not a partisan matter. It is one that concerns each and every one of us, and closely.

The best way to save fuel—coal, oil and gas—is to thoroughly understand how to use it. That this may be accomplished, a knowledge of the characteristics of fuels, the chemistry of combustion, the science of applying the heat of combustion and the engineering knowledge necessary to choose equipment best fitted for the purpose and operate it at all times so as to obtain high combustion efficiencies and utilize to the full the heat obtained is implied. On the surface, the problem appears simple. Actually, the problem is complex.

Knowledge is power. Knowledge, in the case of the use of fuel, is the power to save. It is to the combustion engineers and to those versed in combustion engineering to whom we must look to save our fuels by using them efficiently and without waste.

Ice and the Hydroelectric Development

ICE IS one of the banes of the hydroelectric plant located in northern latitudes during the cold season. Its form and quantity are so uncertain, as also are its severity and its duration. It may cause stoppage or restriction of water flow. It may reduce output by changing the effective head. It may injure the wheels and cause even more extensive damage.

Frazil ice forms in large quantities on open water under moderate degrees of coldness. It often forms at temperatures of 20° F. and even higher when there is sufficient wind to cause agitation. When the operator sees ice of a leaden hue like saturated snow floating in patches over the water he looks for trouble, for frazil ice clings tenaciously to metal parts such as racks, wheel guides, the wheels and gates. The collection of this spongy mass always restricts and frequently obstructs entirely the flow of water to the

wheels, and this condition persists until the sun's rays or artificial application of heat to the metallic parts or rising temperature of the water cause a thaw. Fortunately this trouble disappears as soon as surface ice forms in the forebay, as anchor and frazil ice passing under water have less affinity for metal than when they are exposed to currents of air. Anything done to reduce the circulation of air around metallic parts is just so much gain, therefore, toward eliminating the difficulties of frazil ice.

Loss of output often occurs because the discharge becomes clogged with ice, the tail-water backs up and the effective head is reduced. Boulders, shoals and similar obstructions in the river channel on the upstream side are other frequent causes of reduced output, since these act as nuclei for the formation of ice, which in turn obstructs the channels, causing the backing up of water and variation of stream flow. Effort made to clear river channels and keep them free is effort well made at this time, and may prevent much concern when the ice commences to "come down."

Where a whole river is dammed, and a series of rapids exist above the dam, difficulty in maintaining flow of water may be expected because of decreased area under the surface ice due to the formation of frazil ice and the combining of anchor ice from the rapids with the floating ice. Dams installed to drown out the rapids and sluices to permit the impounded water to be drawn off from the river's bottom are sound practices and ones that eliminate many troubles. Where protecting works cannot be built, channels should be cut in the surface ice of sufficient width to permit the frazil and anchor ice carried down underneath the surface ice to rise and discharge through the dam. Power-house openings should, preferably, not be used for this purpose as the ice may cause trouble to the wheels.

Where only a part of the river is dammed, considerable variation in water flow may result from floating ice, a condition made worse by some wind conditions. The wind may blow the surface ice against the surface ice along the forebay entrance. Here floating ice may be drawn under the surface ice, to become frozen to it. Then the ice begins to increase in size downward, gradually reaching the channel bottom. Often the channel may become so blocked that little water can flow. In such cases uniform cross-section at the entrance to the channel and for some length thereafter, low velocity of the water and a surface of water free from obstructions all tend to combat cause and effect. Channels, forebays, sluices and dams cannot be built in a day. But channels can be cleared of obstructions before the ice appears, booms can be installed and tugs can sometimes be kept at work in long channels to help keep the ice moving and the channel open.

The time will soon be here when frazil ice, floating and anchor ice, ice jams and allied troubles will be with us again. The time to take most effective action to minimize these troubles is, of course, when designing the hydroelectric development. Precautions taken now, however, and during the next two months in anticipation for what may come with the coming of cold weather may later save much concern for reduced outputs, damaged wheels and structures and service interruptions.

Wireless Telephony and the Transmission Line

WIRELESS telephony for making possible communication between power plants and substations separated by long distances, by difficult and rugged country, has long been recognized, and now that the restrictions that came with the war are lapsing, one may expect the wireless telephone to be taken advantage of more fully as time goes on.

Many are the transmission lines that traverse country where river gorges and inaccessibility by foot make a telephone line expensice to install and difficult to maintain. Extreme weather conditions, sleet and ice, long spans with consequent expensive construction, are other conditions that combine to work disfavor with the telephone line and add to its cost and uncertainty of reliability. The fact that in cases of trouble, which is the time the telephone is most used and most urgently wanted, the metallic telephone line is usually out of service is a powerful factor and an immensely favorable argument for wireless telephony.

As far back as 1913 telephony through the air was employed on the Pacific Coast instead of along the metallic telephone line paralleling the transmission line, and since that time a number of installations have been made and operated with perfect satisfaction. Nor is the wireless telephone installation confined for use with the long-distance transmission lines traveling over sparsely populated and rough country. In fact one company operating a transmission line of only some 30 miles and traversing a well-populated territory with its receiving station within city limits, took to wireless before the war put a prolonged stop to its use. Even now, preparation is being made by several large transmission companies to adopt wireless in their systems.

In some cases the topography of the country traversed makes wireless very advantageous. In some cases there may be a very real financial balance in favor of telephony by air instead of by wire. But the supreme advantage to the operating company of telephoning wirelessly is that communication can be carried on regardless of electrical or mechanical troubles to the transmission line, whereas such troubles usually interfere with, if not preclude altogether, the use of telephony over wires. Wireless is more reliable, it is more safe, and may be more economical financially, than metallic telephony.

Current Events

Section Meetings of Electrical Manufacturers—Illuminating Engineers and Inspectors Hold Successful Conventions

ELECTRICAL MANUFACTURERS DISCUSS STANDARDIZATION.

oAssociation to Appoint General Committee on Standards—Tariff and Exports Also Considered at New York Meeting.

The regular fall section meetings of the Associated Manufacturers of Electrical Supplies were held Oct. 14-15 at the association headquarters, 30 East Forty-second street, New York City. The membership of the sections combined is approximately 300 and this number was in attendance.

In addition to the general work of the sections in standardization of various materials and devices coming under their special attention, much time was given to the matter of the adoption of the standards approved and recommended by the different sections and to the suggestions that these standards should be issued as the standards of the association. A desire to this effect on the part of the sections has been somewhat encouraged by the fact that other bodies have from time to time suggested joint meetings for the consideration of subjects of mutual interest, these suggestions coming from such associations as the American Institute of Electrical Engineers, Standards Committee, N. E. L. A. Wiring Committees, the Underwriters' Laboratories, Western Association of Electrical Inspectors, Compressed Air Society and others. This led to the suggestion that a general committee be formed from the sections, same being approved by the board of governors and counsel, the duties of the committee to be to represent the association in matters of standardization and to evolve procedure by which section standards may become standards of the association and generally to centralize the association's standards work to the end that all interested parties may be advised of proposed action and the necessary provision for same made. Subjects which may come under consideration are substantially as follows:

1. The determination of the relation of the Bureau of Standards at Washington to the initiation of codes, etc.
2. The proposed broadening of the American Engineering Standards Committee.
3. The proposed legislation conferring on the Bureau of Standards the power to establish standards of quality for manufactured product.
4. The desire of other national associations, such, for instance, as the American Institute of Electrical Engineers, to confer and co-operate with the association in the adoption of standards in which there may be mutual interest.
5. The determination of what shall be a standard of the association and the evolution of an orderly process by which, when desirable, the standards adopted by a section may become the standards of the association.
6. The desirability of the collection and preservation of standards already adopted by the various sections in form which shall make them readily available.

All such work would naturally come under the advice of counsel and every possible means taken to avoid complications or anything which might be considered illegal. Work of this kind has been done heretofore, notably in the case of the American Society of Mechanical Engineers in the adoption of a standard for special threads of fixtures and fittings, and it would seem that work of this kind would be of inestimable value to the manufacturers and to the public generally in the adoption of the very best and the elimination of superfluous types, etc.

The matter of the tariff schedule was also considered by all the sections and in arriving at a fair basis for fixing tariff many figures as to costs of material and labor were considered. At a meeting of the chairmen of the tariff committees as appointed from the various sections a resume of the work accomplished was gone over and new plans made for the future advantage of the supply industry.

The matter of exports was also taken up and considered under the supervision of the international trade committee of the association, in which special committees for both tariff and export are doing progressive work.

A dinner meeting of the Wire and Cable Section was held Oct. 15 at the Yale Club, about 65 members attending. As is usual at the meetings of this section, much constructive work was arranged, followed by a most enjoyable dinner and get-together entertainment.

INDIANA CONTRACTORS HOLD PROFITABLE CONVENTION.

State Association Has Interesting Program of Papers and Addresses at Convention.

The Indiana State Association of Electrical Contractors closed its annual convention, held at the Claypool Hotel, Indianapolis, last week, with increased interest in every phase of the work. Electrical dealers and contractors from all parts of the state attended the conference.

Some of the important addresses at the conference were as follows: "The Heating Device License Schedule," by Charles A. Payne; "Live and Let Live," by Samuel Adams Chase, Westinghouse Electric & Manufacturing Co.; "The Work of the National Association," by W. H. Morton, New York, general manager of the National Association of Electrical Contractors and Dealers, and "Electrical Merchandising—Address and Exhibit," by William L. Goodwin, of the General Electric Co.

Members of the executive committee, which is the governing body of the organization, were elected as follows: A. L. Swanson, Evansville, chairman; G. M. Sanborn, Indianapolis, and A. B. Harris, Gary.

Chicago Convention of I. E. S. Proves Most Successful

Large Representative Gathering at Four-Day Meeting on October 20-23—Wide Range of Lighting Topics Discussed

REVIVAL of keen and widespread interest in lighting was shown by the large attendance, close attention at sessions and active discussion of many live illumination topics at the thirteenth annual convention of the Illuminating Engineering Society, which was held at the Hotel Sherman on Monday to Thursday of this week. About 400 members and guests were registered and many others in attendance. All parts of the country, also Canada, England and even distant Japan were represented. The attendance comprised not only illuminating engineers, representatives of lighting equipment manufacturers and purveyors of lighting service, but also numerous public authorities, educators, architects and others concerned with lighting matters.

Over twenty-five papers and addresses were presented in five busy technical sessions held during the four days of the convention. Judiciously interspersed between these sessions were several delightful entertainment features, affording relaxation, good fellowship and pure fun. The convention was not only successful but one of the most profitable ever held by the society.

Opening Session.

The convention was opened Monday afternoon by Homer E. Niesz, chairman of the General Convention Committee, who called on Louis A. Ferguson, vice-president of the Commonwealth Edison Co., to deliver the address of welcome. Mr. Ferguson spoke of Chicago as a big engineering laboratory where many innovations are tried out on a large scale. Some of these, like the use of steam turbines in power generation, the introduction of Mazda lamps, differential rates for central-station service and the campaign for better industrial lighting were referred to. The advance in these lines, as well as in lighting particularly, since the society's last convention in Chicago eight years ago has been very great and the city's lighting interests felt pleased to have the society come here to observe it. In replying on behalf of the society, Louis B. Marks, of New York, dwelt on the prominent part taken by Mr. Ferguson's company in calling attention to the value of productive lighting.

Dr. Hoadley's Presidential Address.

In his presidential address G. A. Hoadley referred to the last two conventions held under the stress of war and he reviewed in a general way the lessons of the war. First was its injustice in devastating so many lands, whereas those of its instigators were scarcely touched by the scourge of war. Another was the miscalculation of the would-be conquerors of the world in assuming their plans would be executed before there could be any formidable opposition. Still another lesson was the splendid co-operation of all our people when we finally became involved in the war.

The I. E. S. membership contributed 101 men to active military service and of these four made the supreme sacrifice. The society's Committee on War Service was very active and through various subcommittees comprising 43 members all told it handled a great variety of lighting problems of great importance in the conduct of the war. These included design of lighting of aviation training camps and buildings thereon, lighting of balloon hangars and grounds, lighting of navy gun and machine shops, protective lighting of various grounds and works, lighting of government workmen's cottages, war-time lighting economies, factory lighting, hotel lighting restrictions, lighting of coal mines, metal conservation in reflectors, etc.

Of the various efforts to combat high prices Dr. Hoadley pointed out the effectiveness of doing so through increase of production and how this may be largely brought about by changing the present inefficient lighting systems in many factories into those that are really good. As an outcome of both men of means and men of toil being thrown into camp together during the war, Dr. Hoadley looked forward to an era of better feeling between capital and labor, an era of real peace but which will have its own old problems largely in new form. Their solution will devolve upon the thinking men, such as compose the major part of the membership of technical and scientific societies.

"The fundamental purpose of this society is to teach the people of this country the necessity for good lighting," said Dr. Hoadley. To those who know the influence proper illumination has upon the mental and moral attitude of those who make use of it, this is a matter of the greatest importance. Good lighting has as its foundation the work done in research laboratories. Research has had a wonderful development in the last 20 years. Modern investigators not only find the truth of any matter being studied, but proceed to show how it can be carried out and applied in practice. Everyone connected with lighting should be keenly interested in the work of the society, which co-operates with all agencies, from the manufacturer of the light source to the user of the light, and which is interested in the discovery and improvement of light sources and the proper use of light.

President S. E. Doane, Cleveland, Ohio, was called on for a few remarks. He touched on the importance of the lighting developments in Chicago and the society's possibilities for doing good in bringing to the attention of the public the need for better lighting. Formerly the matter of lighting was looked upon just as janitor service—a desirable but very minor feature. Now we recognize it as an essential element in production. Its value in this line is shown by the fact that about 65% of incandescent lamp output is used in places where the productive value of good lighting has immediate benefit.

Clarence L. Law, New York City, general secretary, presented the report for the council of the society. The membership is 1145, a slight decrease from

last year, due to the abnormal conditions prevailing. The four sections have maintained their regular activities. Aside from their meetings, there were held several group meetings by local representatives distant from the centers of the regular sections. The finances of the society are in excellent condition.

Report on Progress.

F. E. Cady, Cleveland, Ohio, as chairman of the Committee on Progress, presented the annual report on this subject which as usual was a classical review of the most important developments of the year in the illuminating field. The report also had its customary completeness, comprising 78 printed pages. Among especially noteworthy features mentioned was the growing use of tungsten lamps and decrease of carbon filament lamps. Miniature tungsten lamps have made surprising increases. Two tungsten lamps for motion-picture work are now standardized. Among new units are the 50-watt white Mazda and the 25 and 50-watt mill type Mazda. In England standardization of lamp voltages is now actively proposed.

Some new types of vapor arc lamps are reported, among them another neon lamp. Much headway has been made in searchlights. Electric headlights are being rapidly installed on locomotives and an effort is under way to standardize them. A new arc of considerable promise is being developed for motion-picture projection. Important developments in electric miner's lamps are reported in England.

War restrictions on lighting are reviewed in the report, especially as enforced abroad. Many ingenious expedients were resorted to. Numerous new or changed installations of street lighting are referred to. Unique effects have been produced in spectacular illuminations connected with victory celebrations in New York, Chicago, Portland, Ore., etc.

The campaign for better industrial lighting conducted in Ohio has had good results. Interesting uses of colored lighting are being introduced in numerous theaters. The unfortunate use of the term "fixture" for lighting fittings is being recognized. Fixtures giving several varieties of lighting effects are becoming popular. The report also touches on developments in photometry, physics of light sources, legislation and lighting codes, physiology of lighting, daylight saving, gas lighting, etc.

The progress report was discussed by P. S. Millar and D. McF. Moore, of New York; J. R. Cravath, Chicago; C. M. Masson, Los Angeles; C. O. Bond, Philadelphia; L. C. Porter, Harrison, N. J.; Dr. Louis Bell, Boston, and Geo. H. Stickney, Harrison, N J. Mr. Masson asked for suggestions on lighting of golf links and Mr. Stickney recommended high towers such as formerly used in Detroit. Mr. Porter called attention to the Society of Motion Picture Engineers as eagerly studying lighting problems of their industry and worthy of aid from the I. E. S.

Automobile Headlighting.

A report of the Committee on Automobile Headlighting Specifications, C. H. Sharp, New York, chairman, was presented by W. F. Little, of New York City. At the instance of this committee a three-day session was held in January of all interested in the automobile headlight problem. The outcome of this was that the committee drafted a model headlight law which was slightly revised by the Committee on Lighting Legislation. Further consideration was given to the subject of specifications for acceptability tests for headlights. Four test positions were recommended as follows:

Position 1.—Some point between road level and a point on a level with the lamps in the axis of the car—4800 cp.

Position 2.—In the axis of the car 60 in. above the roadway at 100 ft.—2400 cp.

Position 3.—60 in. above the roadway, 7 ft. to the left of the axis of the car at 100 ft.—800 cp.

Position 4.—At 100 ft. at some point between road level and a point on a level with the lamps and 7 ft. to the right of the axis of the car—1200 cp.

At the suggestion of the authorities in Connecticut these new specifications were offered. Within the past month the authorities in Pennsylvania have requested the committee for specifications to be used in that state. It was suggested that each device manufactured and sold must be accompanied with adequate instructions as to installation. Both Connecticut and Pennsylvania have established an inspector system in which their inspectors use a foot-candle meter.

The discussion was opened by J. R. Cravath, Chicago, who pointed out that positions 1 and 4 give minimum requirements. The work of the committee is of a pioneer character; formerly no one had a conception of what the requirements should be. Educational work on this matter is extremely necessary and in some parts of the country it has been carried out much further than in others. The inspector system should be a valuable means of improving the headlight situation. The use of test stations in connection with garages or oil-filling stations may prove desirable. Dr. Louis Bell, Boston, urged testing with standardized lamps properly adjusted. He believed that it will be possible to get a much better class of headlights through use of the new specifications.

H. P. Gage, Corning, N. Y., spoke of the necessity for teaching three classes that are interested in this matter, namely, the manufacturers of these devices, legislators and users. The manufacturers will be glad to produce better devices if told how to do so. The committee's report should prove of great value of legislators and he believed the public should be educated through garage men, distributors and dealers of headlight devices. L. C. Porter, Harrison, N. J., spoke of the desirability of uniform laws in the different states. The report should help in making the same more effective. He commended a pamphlet published by the Motor Vehicle Department of California in instructing the public on this matter. The difficulties in making lamps uniform were described. Some flexibility in the specifications is therefore necessary. G. B. Nichols, Albany, N. Y., said that lenses vary greatly in quality, some being very highly developed and others very inferior. He felt that the New York legislators will gladly improve the existing law. Norman Macbeth, New York City, believed there is great need for improving the lamp assembly as a whole. Ward Harrison, Cleveland, Ohio, thought it might be desirable to have all headlights tilted down slightly as this would permit use of a simpler lens. Mr. Little said that the greatly varying practice of different automobile manufacturers has prevented this. Therefore, the horizontal setting was assumed to be standard. F. H. Murphy, Portland, said that Oregon is trying to make regulations similar to those of California. He believes that the public is anxious to meet any requirements that solve the problem properly. To secure uniform legislation it may be necessary to have Federal legislation. L. C.

Norton, Los Angeles, said that oil-filling stations in that city frequently have test stations for the use of their patrons. J. A. Hoeveler, Madison, spoke of the new law in Wisconsin which holds that headlights not in accord therewith are prima facie evidence of the unsafe use of highways. This has put "teeth" into the law. C. O. Bond, Philadelphia, said it was possible to use road signs as convenient test stations.

Mr. Little closed the discussion by explaining the inspector system used in Connecticut. Motorcycles are used and when a driver is held up for the first time the headlight situation is explained to him in considerable detail. In Pennsylvania inspectors are to be trained for similar service. He thought that it would be desirable to have an expert adjust the head lamps in all cases.

Street Lighting.

On Tuesday morning three papers dealing with street lighting were presented, the first being by C. A. B. Halvorson, West Lynn, Mass., and A. B. Oday, Harrison, N. J., and entitled "Street Lighting with Low-Mounted Units—Kensico Dam Roadway." The Kensico reservoir is one of the storage reservoirs connected with the water supply of New York City. It includes a massive dam behind which the waters are impounded. At the top of the dam is a roadway 2200 ft. long and 26 ft. wide with a 4-ft. sidewalk on one side and a stone parapet wall 4 ft. high forming the border. This dam is of imposing architectural design and it was desired to illuminate the roadway along its top without use of the ordinary lighting standards. After considerable study it was decided to use lighting units imbedded in cast-iron boxes placed in the parapet wall. This involved special designs for these boxes, for mounting of the lamps, reflectors and a baffle to cut off the direct light of the lamps, which were 6-volt, 108-watt, Mazda C units. The lamps were staggered on opposite sides of the wall and give quite a uniform and pleasing illumination of the entire roadway. The installation is unique in this respect and has been found entirely satisfactory.

The second paper, entitled "Recent Developments in Street-Lighting Units (Electric)," by A. D. Cameron, Schenectady, N. Y., and C. A. B. Halvorson, was read by the former and supplemented by illustrations described by Mr. Halvorson. In pendent units for series Mazda lamps an important addition is the combination of dome refractors and stippled or rippled outer globes. These have some advantage over the use of the refractor alone, on account of appearance and making it easier to clean the single outer surface. A new form of bowl refractor is being brought out with a closed diffusing base. In ornamental units the tendency is strongly toward single units of high candlepower instead of clusters and the standards are being made more slender and unobtrusive. An installation is being made in Saratoga, N. Y., of duplex units in which within the single outer globe there are two lamps superposed. The lower lamp is 600 or 1000 cp. and is expected to burn until midnight, whereas the upper lamp is 100 or 200 cp. and by means of a simple cutout replaces the lower lamp after midnight, thus reducing the operating cost from then on. In parkway and residential lighting there is no need for having upward light as in case of white way lighting. Hence, the use of dome refractors and suitable globes is becoming more common. A new type of one-piece molded porcelain unit is being developed which includes a radial wave reflector and refractor holder. For luminous arc lamps electrodes are now being made under pressures of 500 tons per inch, which give 30 to 40% more light than the standard electrode and an increased life of from 30 to 40%. It is also expected to use glass mirror reflectors with these lamps to still further improve their efficiency. This should make it possible to use rippled outer globes in place of the clear globes now so common. The increased efficiency of the electrodes also permits the use of a lower wattage adjustment on each lamp, thus saving 40 watts per lamp and increasing the capacity of the rectifier. In Detroit 90 to 94 lamps are now operated on each 75-light rectifier. The paper concludes with a warning that the very simplicity and flexibility of the Mazda lamp, which has made it so popular in street lighting, tends toward neglect of proper cleaning and maintenance.

The third paper in this group was presented by F. V. Westermaier, Philadelphia, and was entitled "Recent Developments in Gas Street Lighting." It was pointed out that the police value of street lighting is its greatest importance to the public, and municipalities usually look to this protective value rather than to the illumination secured. Although this should be a municipal concern, the matter is left largely to the utilities furnishing the lighting service. Street-lighting rates are usually on a unit price contract basis and the specifications are rather infrequently changed. A constant tendency is toward cutting down expense. Taking up gas street lighting particularly, the author showed that this is usually separated into supply of the fixtures and operation and maintenance. He described several new types of muutiple mantle lamps and high-pressure lamps. The latter, although considerably used abroad, have found little application in America due to the expense of separate mains and the low revenue derived from street lighting alone. Other units described were traffic guide posts, lamps for viaduct lighting and the interchangeable units used in Milwaukee.

The discussion was opened by Dr. L. Bell, Boston, who showed that both the Mazda and the luminous arc are keeping on developing although it was predicted that one of these would gain ascendency. Both have distinctive fields of their own, that of the luminous lamp being for high-intensity lighting. This lamp has also increased the efficiency considerably and, moreover, has the advantage that it must be cleaned regularly, whereas incandescent units are so commonly neglected. F. R. Mistersky, Detroit, said that in that city the use of the newer magnetite electrode enabled the city to add 1100 new lamps to the former 7000 without adding to the capacity of the station. Ward Harrison, Cleveland, said it is necessary to impress on the authorities that cleaning must be done regularly, regardless of the type of lamp used, and efforts should be made to make cleaning easier. It has been found that the absorption of light by the globes is negligible as compared with that due to dirt. He also called attention to a study made in Cleveland of the relation between street lighting and accidents; the article describing this appeared in the Electrical Review of Oct. 11, 1919. H. B. Vincent, Philadelphia, emphasized the need for discarding lamps that had been blackened from long use just as is the practice in interior lighting. J. W. Cowles, Boston, dwelt on the value of sparkle in street-lighting units. One objection formerly raised to incandescent units was that they lacked this, but this is now taken care of by the new ripple glass which gives the unit life and

animation. Cleaning cannot be laid down in a definite schedule applicable to all streets since it depends on the amount of traffic and dirt met with. Others who discussed the subject were C. O. Bond, Philadelphia; W. T. Dempsey, New York; G. G. Cousins, Toronto, Ont., and C. M. Masson, Los Angeles.

C. A. B. Halvorson closed the discussion on the electrical papers by stating that the lighting of the Kensico dam has been found very satisfactory and meets all requirements. Naturally, he would not recommend it for universal application because the presence of crowds on sidewalks would obviously shut off the light and mud and dirt spattered by passing traffic would likewise obstruct the light. In the particular installation neither of these conditions existed. Mr. Westermaier briefly closed the discussion by calling attention to the fact that stret lighting has not developed as fast as other branches of lighting, especially in the matter of maintenance.

Military Matters.

At this point Gen. Geo. H. Harries was presented to the convention to give some impressions of his experiences in service abroad. He was the first American officer to enter Berlin after signing of the armistice and said that the much-talked of Germany military efficiency, which was supposed to have provided for everything, did not provide for possible defeat. Consequently when this came the army was almost completely demoralized and everything seemed to go to pieces. He told of the lack of records, especially as to prisoners. The conditions in the war-torn countries to the east of Germany were far more deplorable than the American public has any conception of. He said that the German people apparently did not seem to realize that they met defeat. They need light to show that they sinned in making war and to expose their folly in thinking that they were even partial victors. On the other hand, we also need illumination to remind us that the laws of supply and demand and the survival of the fittest still hold, and that the folly of wastefulness, the need to be industrious, loyal to our government and to respect the law and its officers should not be forgotten.

Capt. Chester Lichtenberg, Washington, D. C., presented a paper entitled "Military Searchlights," in which the recent developments in this important line were reviewed at considerable length and many illustrations show. Great advantages were made in this line in making searchlights more powerful, lighter in weight and more portable. Methods were described for testing searchlights. The searchlights in use by the Germans were comparatively clumsy and heavy. Those developed by the Allies and the United States were frequently mounted on light chassis which could be quickly rolled upon a motor truck and transported. This truck carried the generator for furnishing the current. Searchlights were not used close to the front because they could so easily be detected and smashed by heavy gun fire. They were used chiefly back of the lines for finding hostile airplanes at night, frequently in conjunction with parabolic listening devices which picked up the general direction in which the plane was likely to be found.

Two papers on photometry prepared for the convention were read by title only due to the lateness of the hour. They were "A Universal Photometric Integrator," by Frank A. Benford, Schenectady, N. Y., and "A Photoelectric Photometer," by Arthur H. Compton, East Pittsburgh, Pa.

Glare Tests.

The session on Wednesday morning opened with the presentation of a paper on "Glare Measurements" by Ward Harrison, Cleveland. This paper gave the results of tests made with a considerable number of observers viewing an opening illuminated by a lamp until this opening became objectionably glaring. Fair consistency was found in the results, and among the conclusions reached was that the use of an opalized bulb cut down the glare, as compared with a clear lamp, by half as much as an opal inclosing ball. One of the most important findings that the results indicate is that the total light flux that reaches the eye from a source is the most important single factor in the production of glare.

The discussion was opened by J. R. Cravath, Chicago, who said that there have been three kinds of

Members and Guests of the Illuminating Engineering Society in One of Their Lighter Moments During the Thirteenth Annual Convention in Chicago, Oct. 20-23.

glare tests, the first being test of eye fatigue after long exposure; the second, interference with vision, and the third, momentary or snap judgment tests. These latter that Mr. Harrison tried are worthy of being seriously considered on account of their simplicity, speed and convenience. A. J. Sweet, Milwaukee, said it is necessary to judge between the ocular discomfort and the actual depression of visual power. It is interesting in observing that Mr. Harrison found the total flux much more important in glare production than intrinsic brilliancy. F. C. Caldwell, Columbus, Ohio, reported having made similar tests and believed that by using many observers results of considerable value can be obtained. G. H. Stickney, Harrison, N. J., emphasized the need for setting up glare standards so as to permit of drawing a dividing line between what is objectionable and passable in this respect.

Symposium on Industrial Lighting.

L. B. Marks, New York, chairman of the Committee on Lighting Legislation, opened the symposium on application of industrial lighting codes that took the rest of the session. Six states (New York, Pennsylvania, New Jersey, Wisconsin, California and Oregon) have now enacted such codes. Ohio, Massachusetts, Oklahoma, Utah and some ten others either have already provided codes or are seriously considering the subject. This committee has been actively co-operating with the Divisional Lighting Committee of the National Council of Defense and with representatives in practically every state. It is difficult to draw the line as to what is ample for safety and health and as to what is desirable for vision and protection. The society has hesitated to draw a definite line as to just what the glare and other standards should be and has left it to the states to try out various novel features. Many years ago there were made quite a few installations of productive lighting and it was found that many manufacturers were eager to adopt better lighting when its value was called to their attention.

John A. Hoeveler, Madison, Wis., presented a paper on the application of the Wisconsin Industrial Lighting Code. The 1913 lighting rules adopted in the state were completely revised in the 1918 code which now applies to new installations only but after July 1, 1920, will also apply to existing installations. Provision is included for either natural or artificial lighting and suggestions are made for both in the second part of the code. Plans for new factory buildings must be approved as to lighting. Suggestions have freely been made for betterment in such plants and the illuminating engineer also visits existing plants and offers suggestions for lighting. The inspectors try to secure voluntary compliance in existing installations. An effort is being made through meetings, conferences and lectures to educate the contractors since to them is left much in the matter of the designing of an installation. Lectures are also given to factory managers, superintendents and foremen. The factory inspectors hold monthly meetings. Lighting surveys were made in different factories while the code was under revision and these were successful in improving the lighting in all cases. Difficulties may be met when it comes to putting the code in full effect as regards shading local lamps and emergency lighting in existing installations.

John H. Vogt, Albany, N. Y., said that the state labor laws of New York were greatly strengthened after a very disastrous factory fire in New York City in 1911. While the state code was in process of formulation about 18,000 tests were made in various factories during a comprehensive survey. The New York Code in its revised form includes recommendations not only for minimum but recommended practice for various industries. These intensity requirements as to work spaces become mandatory after July 1, 1920, the remainder of the code as to general spaces being already in effect. The inspectors meet frequently and receive instructions through lectures. About 68,000 industrial plants are involved in New York state.

A. L. Powell, Harrison, N. J., read a paper prepared by R. H. Leveridge, of the Department of Labor, Trenton, N. J. In order to make the lighting code effective in New Jersey it was felt that education of the factory inspectors was necessary and therefore a special course of lectures was given in 1918. Meetings of contractors were also addressed at which the code was explained and the essentials of good factory lighting set forth. In all of this work the public utility companies have very freely co-operated. There is being undertaken the education of manufacturing companies so that they may have a more complete grasp of what the problem is, and the advantages to be derived therefrom by good factory lighting. In connection with a safety exhibit it is proposed to have some displays of good industrial lighting.

J. S. Spicer, of the Pennsylvania Department of Labor and Industry, read a paper describing the application of the code in that state where the effort to improve factory lighting has been carried on for about five years. Many accidents showed the need for this work and then the question arose as to what is "adequate" lighting. Adoption of the state code based on that of the I. E. S. cleared this up. Now the manufacturers accept it as a valuable aid in laying out good lighting systems and the inspectors find it invaluable in bringing definite information before the industries, especially in foundries where the need for good lighting was so urgent. The labor interests are showing pleasure at seeing the improvement in lighting. Some complaints have been made of "too much light." These invariably were due to excess glare. The improvement in lighting of plants within the last five years is quite impressive, even to a casual observer looking at the same from passing trains. Some plants find tungsten lamp installations more economical in operation and maintenance than the former arc lamps. Six districts have been established for carrying out factory inspection as to lighting. The details of the work of the inspectors was explained. The code has been found very effective in lighting betterment but it will take several years before all factories are well lighted.

F. H. Murphy, Portland, explained how Oregon secured the law giving the labor commissioner authority to draft a lighting code. Both labor interests and employers' organizations took kindly to the proposed law, which includes a broad definition of places of employment to cover offices also. The commissioner appointed a committee to draft a code and it has reported one which became effective last July. Its enforcement is not drastic.

Romaine Myers sent a letter that the California code is being printed and will become effective Nov. 1, 1919.

A. H. Taylor, Washington, D. C., read a paper by M. G. Lloyd, of the Bureau of Standards, describing

the Federal Code. It includes not only intensity requirements but also definite statements as to cleaning and maintenance, and gives many suggestions as to proper practice. Dr. Lloyd described many installations in arsenals, navy yards and other government plants showing that compliance with this code is not yet what it might be, but it doubtless will be much more complete in the future.

F. C. Caldwell, Columbus, Ohio, described the status of the Ohio Code, which now is in its third proposed form and has been turned over by the committee to the commission. Doubtless it will be made effective in the near future. It includes comprehensive tables of recommended lighting intensities. Professor Caldwell noted that all the codes are almost exclusively educational at present. Their legal aspects have not yet been called into effect, and it may not be necessary to resort to very drastic measures to convince manufacturers of the value of doing the work voluntarily.

Dr. Louis Bell, Boston, described the progress of preparing a code in Massachusetts. The commissioner of labor and industry is very sympathetic and the factory inspectors are also exceptionally keen to have something done. Dr. Bell was requested to draw up the code, which he did, based on that of the I. E. S. After certain hearings it can be adopted with the force of law.

R. E. Simpson, Hartford, Conn., presented a brief paper entitled "Insurance Inspectors and the Code." In this he set forth that the object of all lighting codes is to make conditions safe as to lighting. Experience of the inspectors is that the greatest need for betterment is respecting reflectors on drop lamps and the better illumination of stairways and unfrequented places. The dark surfaces on stairways require much higher illumination than ¼ ft-cdle. Data show there are more fatal accidents due to falls on stairways than are due to traffic accidents on streets. During the war all our military casualties amounted to about 400,000, but at home there were more casualties due to poor lighting alone.

George C. Keech, Chicago, spoke briefly of the prospect of initiating action on a code in Illinois.

Dr. E. P. Hyde, Cleveland, a member of the International Commission on Illumination, said that an American committee composed of P. S. Millar and J. R. Cravath had prepared a very voluminous report to the commission on what has been done by our various states and the I. E. S. in the matter of lighting codes. It was intended to present this to the European countries that have been torn by war as an aid in their reconstruction work.

G. B. Nichols, Albany, N. Y., spoke briefly on the difficulty of getting appropriations for additional activities by state departments; consequently he warned against making the work of enforcement of the codes too expensive.

Prof. C. E. Clewell, Philadelphia, submitted a written communication strongly recommending educational work in extending the influence of the codes rather than strict legal enforcement.

Commercial Aspects of Lighting.

The Wednesday afternoon session was devoted to commercial possibilities, the first address being by R. M. Searle, Rochester, N. Y., on "Opportunities for Extending Lighting Through New Applications." He called attention to the opportunity for bringing up the lighting of side streets to approximately the standard of main streets so as to reduce the danger of accidents from automobiles. Highway lighting is only in its infancy and presents wide opportunities for electric lighting companies. All-day lighting of store windows has extremely high commercial value not only to the lighting company but to the merchant. Mr. Searle also touched on color lighting to reproduce the effects desired in millinery and cosmetic shops. Stairways need much more lighting than has ever been used to reduce accidents. Large possibilities lie in floodlighting of banks, monuments, playgrounds, etc. A very favorable load can be developed from lighting of railroad freight classification yards. Higher candlepower lamps with their higher efficiency should be applied with suitable screening devices. Many other fields for lighting business development were pointed out. Mr. Searle said that perhaps less than 25% of the lighting possibilities have as yet been developed. Lighting companies have shown too much of an effort to keep down the bills of their customers instead of pointing out to them what may be done by greater use of lighting.

Discussion was opened by L. Friedman, Chicago, who called attention to the timeliness of boosting highway lighting. J. D. Israel, Philadelphia, spoke of the high advertising value of store lighting, especially that in display windows. It is necessary to show the merchant that the use of more light pays. J. R. Cravath, Chicago, said that store-window lighting requires higher candlepower to overcome street reflections by day than have hitherto been used. N. Macbeth, New York, spoke of a merchant who reported window lighting as giving him better returns than newspaper advertising; the latter cost him $10,000 a year against $500 for all-day lighting for the windows. He spoke of the possibilities of using daylight lamps in millinery stores and in many other places. O. B. Oday, Harrison, N. J., said that railroad lighting offers a large field for color matching in car painting, for large classification yards and large erecting shops.

Lighting in England.

F. W. Willcox, London, England, made an address on "Lighting in England." When he came to London from this country some eight years ago he found lighting conditions very backward and almost deplorable. These slowly improved but there is still room for a very large improvement. The people are more conservative and not ready to take up innovations. During the war in the effort to minimize the destruction from air raids it was necessary to resort to drastic restriction of all outdoor lighting especially and at first this was done in an unfortunate way with serious results. Later the advice of illuminating engineers secure some modifications of the depressing conditions. Mr. Willcox showed a large number of views of war-time lighting in government munition and airplane works and also in commercial establishments and institutions. Numerous special fittings were shown that were devised to meet Admiralty specifications in some of these plants.

The discussion of Mr. Willcox's address was opened by E. D. Tillson, Chicago, who was glad to see that rugged fittings were being used in at least one country. Here excessive competition leads to the use of light and insubstantial fittings in many places, such as foundries, where they are entirely unsuitable. S. G. Hibben, Pittsburgh, reported some of his observations both in France and in England while in military

service the last few years. He also said that the first impression one has is the extreme backwardness of these countries as to lighting, and yet on closer study he finds many innovations that are worthy of being given serious consideration. At any rate, it is valuable to get the viewpoints on this subject of other countries. Others who discussed the subject briefly were G. H. Stickney, Harrison, N. J., and F. H. Bernhard, Chicago.

Mr. Willcox in closing said it was possible to use air-tight instead of ventilated fittings if ample provision is made for radiation of heat. In English cities one finds higher intensities than are the general practice here, but there is practically no highway lighting. Locomotives are run without headlights; therefore, if abundant road lighting were provided, automobiles could do so likewise. He briefly described the use of adjustable drop and rise lamps which are very popular in England and give no trouble. He hopes to see an industrial lighting code of national scope adopted in that country. He also spoke of the British Illuminating Engineering Society and the possibilities of further development through its existence.

R. O. Eastman, Cleveland, Ohio, presented a paper entitled "A Survey of Industrial Lighting in Fifteen States." This survey was carried out for the National Lamp Works, of Cleveland, in the effort to study the lighting conditions actually prevailing in factories throughout the country. It was carried out by laymen to get commercial results. It involved the study of 446 plants and was intended to be qualitative rather than quantitative. Very valuable data were presented in the paper, which will be reproduced in an early issue of the ELECTRICAL REVIEW.

The discussion of this subject consisted chiefly of questions by H. B. Vincent, Philadelphia; F. W. Willcox, London; P. C. Burrill, Milwaukee; A. B. Spaulding, Harrison, N. J.; M. Luckiesh and E. A. Anderson, Cleveland. Mr. Eastman answered these questions in closing.

E. W. Leeper, representing the Chamber of Commerce of the United States, made a brief address asking the Society to co-operate with the Chamber in extended propaganda aiming to help solve the most important business problems now before the country.

CLOSING SESSION.

On Thursday morning, the first paper presented was by O. R. Hogue and J. J. Kirk, Chicago, entitled "Factory Lighting—A Central-Station Problem." This paper gave the experience of the Commonwealth Edison Co. in a campaign for better industrial lighting. During this campaign a very extensive survey of the conditions in Chicago industrial plants was conducted, the results of which are given. A more extended abstract of this paper will appear in an early issue. This paper was discussed by C. M. Masson, Los Angeles; O. L. Johnson, Chicago; R. E. Harrington, Harrison, N. J.; J. E. Hoeveler, Madison, Wis.; A. L. Arenberg, Chicago, and Mr. Hogue.

A paper on "Illumination of Artistic Interiors Without the Use of Pendent Ceiling Fixtures," by A. D. Curtis and J. L. Stair, was then presented. It showed that recent developments in the use of cove lighting, wall boxes and special brackets, floor lamps and pedestals, urns and special devices make possible the lighting of interiors by equipment that is practically concealed. Many unique effects are thereby obtainable and the architectural scheme frequently enhanced through the absence of the customary ceiling fixtures. Numerous installations of this method of lighting were illustrated and described, these dealing with theaters, hotels, banks, homes and the new House of Parliament Building in Ottawa, Can. The paper was discused by A. L. Powell, Harrison, N. J.; F. W. Willcox, London, and Mr. Curtis.

UTILIZATION COEFFICIENTS.

A paper by Ward Harrison and E. A. Anderson, Cleveland, Ohio, entitled "Coefficients of Utilization" was presented by Mr. Anderson. It described a simple method for the direct determination of these coefficients applying to installations of all types of lighting units in rooms of varied proportions and different ceiling and wall colors. Data were tabulated from a series of several hundred illumination tests made in a room with reflectors having three fundamental forms of light distribution. Typical coefficient of utilization tables as determined for different reflector types in common use were included.

The last paper presented was by V. R. Lansingh, Cincinnati, on "Walls and Floors—Their Effects on Lighting." The paper was read by W. F. Little, New York. It gave the results of experimental tests in a small room to determine what influence walls and floors of different colors have on utilization factors. Conclusions reached were that the floor color may affect the illumination as much as 15% and the wall color may produce as much as 25%.

The last two papers were discussed by A. H. Taylor, Washington, D. C.; J. L. Stair, Chicago; N. Macbeth, New York; W. Harrison, Cleveland; A. L. Powell, Harrison, N. J.; F. W. Willcox, London, and Messrs. Little and Anderson.

Prof. Gitaro Yamakawa, of Tokio, Japan, made a brief address on lighting conditions in that country. In illumination Japan is far behind but is trying very hard to catch up. A few years ago an illuminating engineering society was formed in Japan. It has about 750 members. Japan is very much indetbed to America for science in general and for facts regarding lighting.

D. McF. Moore reported the findings of the Committee on President's Address and J. D. Israel presented the report of the Committee on Resolutions. M. B. Webber, Boston, in moving the adoption of the resolutions, said that it was the most successful convention ever held by the society. Before adjourning the convention, Dr. Hoadley turned over the stewardship of the society to President S. E. Doane, who also spoke of the convention as the most valuable one yet conducted by the society.

ENTERTAINMENT FEATURES.

For relaxation there were provided a number of entertainment features. These included the president's reception and dance on Monday evening, a visit to the Chicago Electrical Show on Tuesday afternoon, a theater party Tuesday evening, a special automobile tour and luncheon for the ladies on Wednesday, the annual banquet Wednesday evening, and inspection trips to lighting installations on Thursday evening. Each of these features was marked by numerous innovations and heartily enjoyed by all who participated. The theater party on Tuesday was made a celebration of the fortieth anniversary of Edison invention of the incandescent lamp—Oct. 21, 1879.

On Tuesday President Doane gave a luncheon to the officers of the society, at which plans for the year's work were discussed.

N. A. E. I. Holds Convention at Springfield

Revision of National Electrical Code from Field Data Principal Topic at Reconstruction Meeting

AMONG the subjects under consideration at the reconstruction convention of the National Association of Electrical Inspectors, held at Springfield, Mass., Oct. 13-14, were those concerning the relation and value of electrical inspection to the various branches of the industry, and the necessity of obtaining information from the field regarding the working out of the rules of the National Electrical Code so that the revision may be consistent with practice. The subject of polarization and protective grounding received consideration along with other papers, discussions on all of which were at some length.

The convention was called to order Monday morning, Oct. 13, by Allen W. Hopkins, past president of the Western New England Section, National Association of Electrical Inspectors. He introduced Arthur A. Adams, mayor of Springfield, who welcomed the association and its friends to the city. Response was made on behalf of the association by President Washington Devereux of Philadelphia.

Past-president Thomas H. Day, chairman of the committee on arrangements, gave a brief explanation of the different committee activities and plans for the routine business of the convention and for the entertainment of the members and their friends.

Beginnings of the Code.

President Devereux then introduced F. Elliot Cabot, secretary of the Boston Board of Fire Underwriters, who gave an address upon "The Beginnings of the National Electrical Code." He was the first chairman of the electrical committee and, with C. M. Goddard, secretary of the New England Insurance Exchange, made the initial efforts toward bringing into existence the National Electrical Code. Mr. Cabot told the convention of these early efforts. There was a brief discussion initiated by A. E. Braddell of the Sprague Electric Co., who was one of the earliest inspectors in the field, after which on motion of Mr. Day a committee consisting of H. S. Wynkoop, A. E. Braddell, Washington Devereux, G. S. Smith and E. S. Francis was appointed to draw up a suitable set of resolutions recognizing the past services of Messrs. Cabot and Goddard in the creation of the Code, to be engrossed and presented to the above-named gentlemen in the name of the association.

Clarence D. Tuska, Hartford, Conn., read a very interesting paper on "Radio Developments and Their Relations to the Code." At the close of the paper it was voted that the secretary forward to the secretary of the electrical committee, National Fire Protection Association, the recommendation of the association that wherever in the Code the words "wireless telegraph apparatus" appear they be replaced by the words "radio apparatus" and that the word "antenna" be similarly substituted for the word "aerial."

At the Monday afternoon session T. Commerford Martin read a paper on "Electrical Inspections and Their Beginnings," which was largely reminiscent and brought out many interesting facts in connection with bygone days. The speaker exhibited a selection of antique fittings which occasioned much interest; there were wooden cleats, cutout bases, receptacles and similar curiosities. He stated that it was proposed to establish a museum of relics in New York to perpetuate the methods of early days. If any of the association members or others have in their possession any of such or other interesting samples of bygone fittings and appliances it is much desired that they communicate with Mr. Martin and if possible send such to him for the above purpose.

Symposium on Electrical Inspections.

Gilbert S. Smith of Philadelphia, president of the Pennsylvania Association of Electrical Contractors and Dealers, read a paper on "Electrical Inspections and the Electrical Contractor." He outlined from the contractor's point of view the relations existing and which should exist and gave a very interesting description of the methods of promoting good relations, clear understanding and co-operation among the contractors, wiremen and inspectors by Washington Devereux in Philadelphia through the workings of his weekly conferences.

"Electrical Inspections and the Power Company" was the title of a paper by Percy H. Bartlett, engineer of installations of the Philadelphia Electric Co. He began by stating that he could present only his own personal viewpoint and that he felt one of the association's principal aims should be to iron out differences of interpretation of the Code. He spoke of the possibility of some "safety inspection" by the state or similar body unless the present inspection authorities control this as well as fire dangers. As to inspections by power companies, he felt that being in the business primarily to manufacture and sell electrical energy, these should confine themselves closely to that business and could do it better if inspections were not included in the companies' functioning. He stated that out of 8000 reports of interruptions of service in one month by his company, 7000 were found to have originated in fuses blown by domestic appliances improperly operated.

Mr. Bartlett told the method by which the Philadelphia Electric Co. was kept informed of inspection progress. After an application for inspection was received by the department the inspector made his visit and sent a copy of his report not only to the contractor but the company as well; similarly when any defects found were corrected and when a temporary certificate of approval was sent the contractor a copy was left in the main service switch box, which was the direct authorization for the company's representative to connect the service. He stated that he approached the question of municipal versus insurance inspection with some diffidence, but that in his opinion on account of the financial leverage (among other reasons)

the insurance departments were the more logical and suitable of the two.

The next speaker was Ralph Sweetland, assistant secretary of the New England Insurance Exchange and secretary of the electrical committee, National Fire Protection Association, who addressed the convention on "Electrical Inspections and Their Value." He made six subdivisions: value to the property and owner, to the municipality, to the insurance company, to the manufacturer, to the jobber, and to the contractor.

Under the first head he stated that although some owners of property at first looked upon it as a hardship it was usually not the case with the larger owners and that when it was the owner was regularly brought to see the immediate value to him not only in security but in proportionate increase in income-earning power of the property. Although large buildings were built under supervision of an engineer and strict specifications, still the engineer was strongly impressed with the value of an outside and wholly unprejudiced inspection.

As to the municipality, it has a very direct interest because the use of electricity is so widespread, and there is the probability that faulty equipment in one building may have an injurious effect upon neighboring holdings and may further cause innocent citizens damage, as well as expose the municipality as a whole to fire hazard. The importance of the work of electrical inspection was frequently overlooked and minimized by the public because, while the police department was always on view, the fire department more or less spectacular, the electrical inspection department was distinguished by the fact that when its work was well done nothing happened, so that the more efficient it was the less it appeared before the public at large.

As to the insurance company, it would be enough to compare the permit for the use of electricity as it formerly was written in the policy with the simple form used today which was practically "permission is granted for the use of electricity for light and power purposes in the insured property," the broad, unconditional form being largely due to the results of careful inspection.

The manufacturer is assisted because through careful inspection he is furnished with a mass of field data and similar information which materially assists him in the detection of weaknesses and in the maintenance of standards.

The jobber is benefited because he does not have to carry in stock a lot of cheap material in order to meet thoughtless demands or keep business, since he knows that poor grade non-approved material will not be passed and therefore need not be carried in stock, however beguilingly the salesman may present it to him.

Inspection is of value to the contractor who does high-grade work because he is protected therein. It is also of value to the cheap fellow because he is either forcefully pulled up into the other class, where he becomes a credit to himself and makes a success of his business, or he is on the other hand rapidly eliminated from the field, to the great benefit of others and also to himself as he is prevented from losing what little money he may have through his slipshod methods.

Lastly, Mr. Sweetland disagreed with the preceding speaker in that he believed electrical inspection was distinctly the function of the municipality; he did not believe in a single state inspection, however, keeping in mind that the closer most things are kept to the community interested the better. He realized that there were many small towns which could hardly afford to employ a competent man for this purpose, but saw no reason why several should not combine and employ one jointly, precisely as they do today in the case of a superintendent of schools.

In the discussion which followed there was a very interesting argument over the matter as to how far a power company would be justified in refusing to supply current to installations which they believed dangerous. President Devereux stated that this right was established and that they had the full power; in fact, would be held criminally liable if current was supplied to a service known to be dangerous to life and property. Mr. Devereux cited a case in the New York courts to substantiate his proposition. Harry Blood disagreed and cited a case, also in New York, where a company decided to cut off certain bad risks and the Public Service Commission of the Second District said this was not the company's affair and ordered it to supply current. After some argument, A. M. Paddon, Syracuse, N. Y., took a hand and lucidly distinguished between the two cases. First, in Mr. Devereux's case, there had been serious trouble in the risk and the company had given warning and received a promise that the difficulty would be corrected. This was not done, however; the company thereupon cut off the supply and was, as Mr. Devereux stated, sustained by the courts. In Mr. Blood's case the company suspected some bad risks, ordered all its customers to have their installations inspected and that if this was not done within 30 days current supply would be cut off. As a result the Public Service Commission made the ruling precisely as Mr. Blood stated.

Outside Wiring and Building Services.

The final paper of the afternoon was presented by Dr. Morton G. Lloyd, Bureau of Standards, upon "Outside Wiring and Building Supply and Services." Dr. Lloyd discussed the present regulations of the Code from the standpoint of the sub-committee of the electrical committee, National Fire Protection Association (which must have prepared any proposed revision by Dec. 1 of this year), of which President Devereux is chairman. The following questions were expounded:

Shall the service switch be invariably inclosed? If so, shall the switch or the service fuse come first? Should there be a fuse at the service end of the service conduit? What should be the proper protection for the service conduit and service wires?

In outside wiring cleats are not allowed; knobs are allowed where wiring is not exposed to the weather and petticoat insulators where it is exposed. How about iron racks with porcelain cleats and brackets? Is there any field experience that these are not safe and allowable? If permitted, what should be the limitation?

What requirements should be specified and what regulations for the use of multiple-conductor cable for service? Are the present requirements of Rule 12*b* satisfactory or onerous? Are they being strictly followed or are they not? If not, why not?

At present all line wires must be insulated. Is this desirable, and, if not wholly so, then to what extent? Should the limit be, say wires for 2300 volts and under? What is the field experience and opinion?

Rule 13 is obsolete and in process of revision.

What information can inspectors in the field give that will help?

Finally, how about oil-filled transformers in buildings or attached to the walls outside? What light can be thrown on Rule 14 and others in this connection?

It is strongly felt that the inspectors of the country are in possession of a very great mass of information which would be of material help in the revision of the Code. It will be too late to present this in March. Such material must be in the hands of the committee by Dec. 1. It is very hard to get it from the men in the field. Opinions are not wanted so much as facts—what actually happened in the field and what were the circumstances. Anything that members of the association and others have, not only on the matters specially mentioned above but on any others, they are urgently asked to send promptly, either to the secretary (addressing Prof. William Lincoln Smith, Northeastern College, Boston, Mass.), who will forward it to the proper authority, or directly to Ralph Sweetland, secretary, electrical committee, National Fire Protection Association, 141 Milk street, Boston.

At the Tuesday morning session H. S. Wynkoop, electrical engineer of the Bureau of Gas and Electricity of New York City, read a paper on "Inter-building Service Connections." This practice is found where a block of buildings separated each from each by a fire wall is put up as a unit. Each individual would require, say 15 amperes from a three-wire service, and usually it is found that the installation of individual service for each unit from underground mains would be prohibitive; therefore the company installs a single service manhole with fuses and switch at one corner, the builder runs a conduit straight through the basements of the block, and in each unit is placed a branch service with fuses, switch and meter. The question as to how much this construction or similar schemes are being used throughout the country and whether it should be encouraged is one on which the electrical committee desires as much information as possible.

Code Problems.

Dana Pierce, vice-president of Underwriters Laboratories and chairman of the electrical committee, National Fire Protection Association, presented a paper on "Some Code Problems of Present Interest." He explained the development of the Code from a pamphlet of 36 pages in 1895 to one of 132 pages in 1905 and further to one of 210 pages in 1915, and stated that this roughly measured the increase of use of electricity in 20 years and the increase in hazard; further, that now the size and complexity of the Code had reached a point where these were the principal causes of present Code problems.

The chief problem is how to obtain data and field experience absolutely necessary to keep the Code in the forefront of the profession. It is imperative that the committee receive results of field experience in the form of facts as to the working of the Code—not opinion as to what one or another would like to see inserted or omitted, but facts as to how a given rule has worked or failed in a particular case, with exact information as to the conditions and then a suggestion to improve this condition. Mr. Pierce outlined the new form of procedure of the electrical committee which has been fully and widely detailed in the technical press and with which every inspector is supposed to be familiar by this time. It is the hope and purpose of the committee to make the Code rather a record of good practice than an imposition of requirements upon the business.

Standards are of two kinds. There are, first, inspection rules, such as 26*j*, "must be rigidly supported, etc.," and, second, "weasel rules," such as "borders must be suitably stayed and supported, etc.," and as in 37A*c*, "installed in a workmanlike manner." Great judgment must be used in framing these rules. There are the following points among the many which arise:

Heaters—How can the flatiron problem be dealt with? There are now 100 fires a day in the United States due to these alone.

Gas-Filled Lamps—How does its hazard compare with that of the old type? Does it need all the present precautions, or others? How about its use in dusty places?

Varnished Cambric, Paper Cable and Similar Insulations—How about their use in buildings? How support them for risers? What are the difficulties? What rating shall they have compared to older types?

Renewable Fuses—How shall they be handled?

Insulating Joints—This question is being handled by a sub-committee of which J. C. Forsyth of New York is chairman.

Grounding—This matter was supposed to have been settled but now is more vital than ever. One of the largest hotels in New York wired in strict Code accordance had a measured maximum demand last year of only 27%. There is copper in that installation which, as one might say, never sees an ampere. Consider the economic question of tying up all that copper and the financial burden, and then try to visualize the economic responsibility of the makers of the rules. Again take the case of 200 closely adjacent buildings for government housing, each calling for only about 11 outlets for light, all fed from one bank of transformers, with 200 No. 6 service grounds and 200 separate No. 6 service conduit grounds—400 in all; there probably is more copper in the grounds than in the circuits.

Mogul Sockets—How can a mogul socket rated at 1500 watts be used when the present inside branch circuit is limited to a maximum of 1320 watts by special permission? How can one use 500-watt lamps when the 660-watt circuit will only take one and the special 1320-watt circuit but two? Is it reasonable or what sort of circuit should be allowed?

Motor Fuses—Does the Code require that motors shall be protected by fuses? If the answer is "yes," then where is the prescription to tell what fuse should be used to protect a motor of given rating?

Low-Voltage Limit—The committee has been requested to raise the low-voltage limit from 550 volts or less to 750 volts or less. What does field experience say?

Farm-Lighting Plants.—These usually operate at about 33 volts, requiring light insulation and considerable cross section of wires. If insulated suitably for this, and later power from a public service supply is substituted, there is the question of new wiring and scrapping of the old; on the other hand, if originally insulated and installed for 110 volts, there is the burden of higher cost useful only if certain future events come about. What sort of rules shall be made?

The committee, through its several sub-committees and technical sub-committees, urgently desires field experience bearing on these and kindred matters.

J. C. Forsyth, chief inspector of the Board of Underwriters of New York City, presented a paper on

"Insulating Joints; What of Their Future?" As Mr. Forsyth is chairman of the sub-committee on this subject, which was to meet the following day, the paper was more of a running commentary on the matter in general and did not contain matter of a definite nature so much as a probe for information. Mr. Forsyth's committee is earnestly seeking for field experience in this matter and all members of the association and others are urged to help out again with facts and conditions found in the field.

A paper on "Time Lag in Motor Protective Devices" was presented by F. A. Barron, electrical engineer, wiring sales department, General Electric Co., and dealt principally with the methods of protecting small motors individually from overload when the motors are grouped together under the line protection of one set of fuses in accordance with the provision of Rule 8c.

George C. Lawler, electrical engineer, Associated Factories Mutual Insurance Companies, read a paper on "High Potential Wiring." This was too detailed and technical to be summarized here, but probably will be published in full in one of our coming issues.

Polarization and Protective Grounding.

Tuesday afternoon W. J. Canada, electrical engineer, Stone & Webster Co., Boston, read a paper upon "Polarization and Protective Grounding." Mr. Canada, as is well known, has given many years of study to this subject and the result was a paper replete with detailed information. The discussion which followed was prolonged and participated in by many present, turning principally upon the question of polarization. Thomas H. Day suggested a rule to the effect that "on secondary systems having five or more grounded services connected thereto, service conduit grounds may be connected to the service ground wire."

Dana Pierce commented in detail upon the whole economic question of the present (but temporarily suspended) polarization rule. He touched upon the hinted cost to the manufacturer for changes in the machinery, as to whether all types and sizes of wire should be marked or only the small branch wires, spoke of the customary manner of buying wire and installing circuits, of sizes like 500,000 circular mils purchased almost inch by inch. He suggested trying the plan for a year or so of marking the wires on the job at the outlets. He thought the provision must be justified economically and said that while manufacturers generally were ready to accept it, they felt that before making changes they should be sure it would go into effect and be strictly enforced. Again there was the question of the marking of devices.

Dr. M. G. Lloyd said the difficulties were much exaggerated, that the wires of whatever size could be amply polarized by banded marking at outlets, or at very small expense colored braids could be used, as has been done for years in telephone work, where one can go anywhere and always identify the wire. For bare wire there could be black and gray rubber; for Bx or duplex wire two dyes, and as to the cost of marked fittings how much would a plus and minus sign on the die or mold cost.

Visual Marking of Fuses.

The final paper, which was presented by Past-president Thomas H. Day, dealt with "The Visual Marking of Fuses," excerpts from which appear on other pages of this issue. The speaker brought out the faults of the present system. It is frequently the case that the pasted label or ferrule marking on cartridge fuses is not visible without turning them in the clips, which, because of the rivet heads, tends to spring and loosen the contact. The marking of plug fuses is often obscured by the size and amount of other stamping, trademarks, etc., and there is often objection to inspectors opening the circuit even long enough to examine the fuse bottoms. Several methods of improved marking were discussed and the matter recommended to the Underwriters Laboratories for further consideration.

The association annual banquet, held Monday evening, was attended by 130 members and friends. A. E. Braddell presided as toastmaster and responses were made by H. W. Blood, Boston; J. C. Forsyth, New York; Washington Devereux, Philadelphia; Thomas H. Day, Hartford, and G. S. Smith, Philadelphia.

LARGE ATTENDANCE AT CHICAGO ELECTRICAL SHOW.

Exhibitors Pleased with Merchandising Results at Show and Vote to Hold Another One, Probably Next Year.

Attendance figures for the Chicago Electrical Show, which opened Oct. 11 at the Coliseum and closes Oct. 25, indicate that over 80,000 people paid to see the show. The crowds, especially in the evenings, taxed the capacity of the immense auditorium, and demonstrators were kept busy introducing to the public the many electrical devices on display at the show.

At a meeting of the exhibitors held this week, E. W. Lloyd, manager of the show, asked for expressions of opinion concerning the exhibition. Replies from representative manufacturers, jobbers, and contractors emphasized the success of the affair from a merchandising point of view. It was the concensus of opinion that another show be held, probably next year.

One of the features that attracted a great deal of attention at the show was the wireless telephone apparatus. A government aeroplane was equipped with wireless telephone and the words spoken by the flyer were received in the booth of the Signal Corps at the show. So that the visitors to the show might gain an idea of the unlimited opportunities of the wireless telephone, the Signal Corps exhibit arranged a number of microphones through the hall in order that the words of the flyer be heard distinctly all over the Coliseum.

DISCUSS TRACTION PROBLEMS AT NEW YORK MEETING.

Speaking at a monthly luncheon meeting of the New York Electrical League, held Oct. 14, Lewis Nixon, New York Public Service Commissioner for the First District, indicated that a compromise between the New York City traction companies and the city authorities might be reached whereby the companies would relinquish some of their special privileges in return for an increased fare. Mr. Nixon stated that he believed the solution of the problem lay in the application of a flexible fare. The zoning system, he believed, is impractical in New York City because much of the city's growth and industrial expansion was effected on the principle of a universal transit fare.

Commercial Practice

Sufficient Outlets Advocated — Enormous Market for Electric Household Devices—Electrical Dehydration of Oil

CENTRAL STATION ADVOCATES USE OF SUFFICIENT OUTLETS.

Canadian Company Advertises to Contractors and Dealers to Urge Customers to Provide for Additional Outlets.

The doctrine urging the home builder to provide sufficient outlets for all demands is one that is being preached by all branches of the industry. In a recent advertisement, the Toronto Hydro-Electric System made these suggestions to contractors and dealers:

"When wiring buildings don't cut the size of wires to a minimum. Educate your customers to provide spare capacity for the increasing demands which are sure to follow. Show the consumer, say by means of alternative prices, the small cost of providing for future demands in the original installation. Nor does your interest in a customer end when the wiring is completed. He is still a prospective customer, and a satisfied customer is the best advertisement—an unsolicited testimonial, a talking sign, that walks, too!

"When wiring residences don't fail to urge an adequate number of outlets, and be sure they are conveniently located. A customer may not be sure just what he needs in advance, therefore sound advice is welcomed, and when it works out in practice as you promised, the customer will tell his friends of your ability.

"Standardize your outlets. It means efficiency and true economy, which benefits you in the long run."

ENORMOUS MARKET FOR ELECTRICAL HOUSEHOLD DEVICES POINTED OUT.

Address Before American Washing Machine Manufacturers' Association Emphasizes Opportunity.

Speaking before the American Washing Machine Manufacturers' Association on October 16, Raymond Marsh pointed out the vast field existing now and in the future for electrical household appliances. In part he said, after telling of the number of wired houses, rate of increase in wired houses per year, and the number of appliances sold annually: "At the very outset I ask you to note that present day conditions make 'electrical household specialties' a necessity—and not a luxury—in every one of the seven million homes wired for electricity. In addition, the remaining fifteen million homes in this country are now demanding household specialties, not electric, such as hand, water, and gasoline-power washing machines, gas ironing machines for household use, etc.

"'The electrical household specialties' industry is still in its infancy. Americans are noted for the ingenuity they have used to develop labor-saving devices and machinery; but, although leaders now in the development of household labor saving devices, their reputation in this respect is as nothing compared to what it will be five or ten years from now.

"In 1919 there were 3000 manufacturers of electrical devices.

"Out of about 15,500 hardware dealers rated at over $5000 in this country only about 2500 or 16% are selling electrical household appliances.

"In the early days of the washing machine business the manufacturers distributed a large proportion of their production through the hardware trade, jobber and dealer. The relation which was developed between the hardware dealer and jobber and the manufacturer was, and still is, equitable and profitable to all parties concerned.

"During the last several years, however, the proportion of the production of the washing machine industry distributed through the hardware trade, dealer or jobber, has declined and not increased. This is an unfortunate condition; and, yet, it is a fact which you gentlemen should face and endeavor to remedy. If the manufacturers are at fault for this condition, they would like to know it. If the hardware trade is at fault, then, surely, you, gentlemen, would like to know it.

"The present demand for household labor saving devices, electric or driven by other kinds of power is far in excess of supply. Numerous manufacturers of these devices have doubled their producing capacities and deliveries within the past year. They are using every intelligent, legitimate effort to increase production and they are getting results in spite of handicaps merely suggested by the phrases—labor problem, transportation difficulties, shortage of basic materials such as motors, wringers, polished and trimmed copper sheets, etc. In our industry, alone, we can show results in the way of increase of deliveries, by units and not money, of over 95%—comparing our deliveries by units second quarter 1918 to second quarter 1919. These are facts beyond dispute which show that the household specialty industry is a growing one which you gentlemen cannot and dare not neglect.

"Today, with all of the increase in production, the manufacturers of household labor saving devices are far behind on orders. The demand for these devices has just started. The hardware trade, to some extent, is cashing in on the demand, today, but it must prepare itself to meet the demand of tomorrow and the conditions of tomorrow.

"What will the demand be tomorrow and what will the conditions be tomorrow?

"Every user of a hand, water or gasolene power household labor-saving device is an excellent prospect for an electric power device as soon as the home is wired. The rate at which homes in this country are being wired is remarkable. On this point, I suggest that you get in touch with the Society for Electrical Development from which you will get figures which will astound you. Here is a perpetual motion proposition; and one on which you should plan to make money. You have already made money in selling the

hand, water, gasolene power devices; now turn around and sell the same customer the electric power device.

"The women of this country are directing their energy toward the factory and the office and away from the household duties. 'Uncle Sam' is urging increased production to reduce the cost of living. Women are doing more than their bit in this job to increase production; and as the scope of their work develops and broadens they will have less time to devote to household drudgery—and, under present conditions, drudgery is exactly the word to use in describing household work. These women are learning about machinery, production, labor-saving machinery, the planning of factory work—and they are fast losing their fear of machinery of any kind or description.

"Who or what will clean and iron the clothes, wash the dishes, clean the rugs, cook the meals, etc.? Household servants and washwomen are now so scarce, in a relative way, that they are demanding and getting fortunes for their services. The sky only is the limit by which they set their daily wage. The answer is—washing and ironing machines for household use, electric dish washers, vacuum cleaners, toasters, ranges, etc.—the whole series of electrical household specialties for use in the city and in farm homes by reason of individual farm-lighting plants.

"The demand for these devices will greatly expand because we are not developing a servant class in this country. Unlike in England and in France your wife or my wife cannot find a servant who is or will be proud of her job and proud of the fact that she works for you or for me. Servants' and maids' unions may be formed here as they have been in England and France, their hours of work and rates per hour may be standardized here as they have been in England and France; but the fact remains that, in a relative way, good household servants are as scarce as hen's teeth and that we are not developing a servant class in this country.

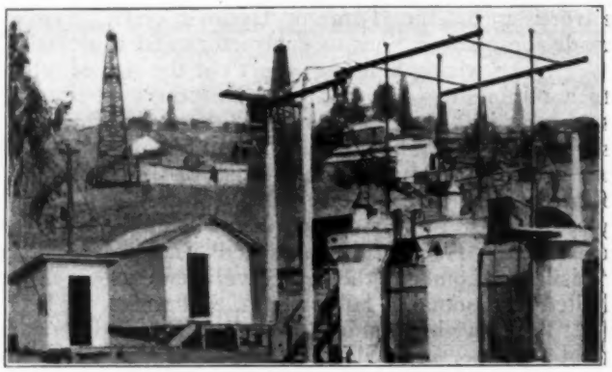
"Household servants are making it a condition that the home be furnished with labor-saving machinery if they are to stay. The housewife, if she has no servants, now realizes how much more of a necessity these labor-saving devices are. On the point of solving the problem of clean clothes for the family, she knows, only too well, that the most economical and the most sanitary way of getting clean clothes for the family is to have the washing and ironing done in her own home. She has had all she wants of the public laundries.

"The jobber or the dealer handling most of these articles today is in a position to pick and select his customers. Demand exceeds supply. Deliveries because of shortage of certain basic raw materials in many cases are slow and uncertain. The jobber or the dealer who takes his discounts is getting the better service. He, in turn, selects the customer who takes the discount and who pays cash. The whole industry is being placed on a more solid basis and foundation. Plans for financing customers who purchase on deferred payment plans have been developed which will adequately and properly protect both dealer and customer. Here is an industry with unlimited powers of expansion, with possibilities indescribable. Its product is an absolute essential under modern living conditions. Properly planned, the industry will develop on a most solid foundation. Manufacturers of automobiles now sell their product cash against documents. Why should not the manufacturers of these electrical household specialties do likewise? By so doing they will develop for themselves a most responsible group of jobbers and dealers who can adequately cover their respective territories and who will make out of their distributive function real profits commensurate with the opportunities now open in this great field of industrial endeavor."

ELECTRICAL DEHYDRATION OF CRUDE OILS SUCCESSFUL.

Removal of Water from Crude Oils by Electrical Method More Efficient Than Former Methods Used by Oil Producers.

Petroleum producers have been confronted with the problem of removing water from crude oils ever since oil was discovered. It can be accomplished by the application of heat, centrifugal force or by chemical action, but electrical dehydration has proven so



Electrical Apparatus for Dehydrating Crude Oil.

much superior to the other methods that its adoption is virtually a necessity, says H. N. Sessions in an article in *Edison Current Topics,* published by the Southern California Edison Co., Los Angeles, Calif.

The presence of water in crude oil is natural and inevitable, and is caused by the infiltration of water into the strata of oil-bearing sands. Water may be present in crude oil in the form of large free globules which settle out in time if allowed to stand, due to their greater specific gravity, or small particles of water may be held in suspension or trapped in emulsion with the oil and these will not settle out at normal temperatures and pressures even if the mixture is allowed to stand indefinitely.

The weight and volume of the water particles carried in suspension depends upon the viscosity, temperature and gravity of the oil; hence there is no fixed ratio between the water held in the free globules and that contained in the particles of water in emulsion. Some producers dispose of their crude oil without extracting the water from it and the purchaser is allowed a rebate on the percentage of water he is able to prove the oil contains. Such practice is characteristic of the early-day wastefulness in the oil fields, when little regard was given to economy and efficiency in handling and marketing crude oil.

Not to dehydrate at the wells works an injustice to all concerned. The carload freight rate on crude oil from Bakersfield to Los Angeles is 4 cents per bbl. and the shipment of a 12,500-gal. car of undehydrated oil which carries 35% water in emulsion means that some one must stand the transportation expense for 4000 gal., or 30,000 lbs., of water in the car. This

reduces the useful capacity and purpose of expensive rolling stock and makes the freight cost of the oil delivered, less the water, 6 cents per bbl. The oil could be dehydrated electrically before shipment, including all costs and royalty, for less than 2 cents per bbl. with electricity at 2 cents per kw-hr.

There are 17 electrical dehydrating plants now operating in the Whittier district in California. The first electrical dehydrator was installed by the Standard Oil Co. in 1913 on the Murphy-Coyote lease. The oil companies using the electrical equipment are enthusiastic over the results obtained and in many cases oil heretofore unfit for use and rebellious to other methods of dehydration is made marketable by the process of electrical dehydration.

The oil treated in the above-mentioned 17 plants ranges from 15 to 50% water, and the average amount of oil net after treating is approximately 18 bbls. per kw-hr., or one-ninth of 1 cent per bbl. for electricity at the rate of 2 cents per kw-hr. Electrical dehydration causes practically no loss of gasoline and the records show that after treatment the gravity of the oil is raised from one to two degrees, giving it in consequence an increased market value. This increase in market value in some cases is enough to pay the cost of dehydrating. The opposite is true in the heating process because crude oil containing any appreciable gasoline will suffer evaporation under the temperature necessary to break down the emulsion, and naturally the loss of gasoline means less dehydrates, less gravity and less market value.

The heating process necessitates close watchfulness, the electrical practically none. The heating process discolors the oil, impairing its market value; the electric dehydrator clarifies the oil, leaving its natural color. The low fire hazard with electricity is also important.

A record run of 7000 bbls. of the same grade of crude oil was made, first by the heating process, then by the electrical, 18 hours being required with the heating process and only 7.5 hours with the electrical. The net amount of oil was 5150 bbls. with the former process and 5160 bbls. with the latter. The total cost of the heating process for this run was $387, or 7.5 cents per bbl., while the entire expense with electricity, even including a royalty of 0.5 cents per bbl., was $102, or slightly less than 2 cents per bbl.

The electric dehydrator effectively treats oils of different grades at the same time without in any way impairing their efficiency. On a test, 28 gravity crude oil containing 25% emulsion at a temperature of 70° was cleaned simultaneously and separately with 13 gravity oil containing 30% emulsion at a temperature of 180° by the same electric dehydrator and the dehydrates showed only 1.3% water and foreign matter in suspension, a limit of 2% being permissible.

Oil containing 85% emulsion has been successfully dehydrated electrically. The Quintuple Oil Co. in the Whittier district electrically dehydrates oil as it comes from the well from a mixture of 12% water to only 0.1%.

The electric dehydrating plant is made up of units called treaters. The usual size is a four-treater plant and the cost installed is about $2000 per treater. The cost of installation is generally borne by the oil companies and the ownership of the dehydrator is retained by the manufacturers, who also exact a royalty from the oil companies on each barrel of dehydrate produced. There are several successful electric dehydrators on the market. One manufacturer claims to have placed machinery which is now cleaning about 2,000,000 bbls. of emulsion per month.

In general, the electric dehydrator operates on a single-phase alternating current at a pressure of 11,000 volts. The emulsion is passed between highly charged electrodes and in this electrostatic field the small globules and particles of oil, by static attraction for each other, form in chains which in turn coalesce into free water that readily settles to the bottom of the treater and can be drawn off. In certain leases where water is very scarce, the water electrically removed from the oil is of considerable value.

Due to the condenser effect caused by the highly charged electrodes, the electric dehydrator operates at about 98% leading power-factor. The average maximum demand per hydrator is 4 kw., the average load-factor 50%, and the average gross income approximately $25 per month.

LAST ISOLATED PLANT IN CITY OF PUEBLO GOES OVER TO CENTRAL STATION SERVICE.

Arkansas Valley Railway & Light Co. Takes Over Plant That Had Been Landmark.

The last isolated plant to operate in the city of Pueblo, Colo., has gone over to central-station service, a process that has been going on surely and steadily for a long time. One by one the isolated plants have shut down and purchased service from the Arkansas Valley Railway & Light Co., until only one isolated plant—isolated in every sense of the word—remained. Now there are no more isolated plants, the last one to go having a capacity 138 hp.

Word also comes from Pueblo that an interesting development in the new business being taken on is an increasing demand for electric ranges. One 36-apartment building to be constructed soon will have an electric range in every kitchen. The electric appliance business of the company and dealers continues to break records.

A canvass recently made of the prospective new business in the territory served by the company shows that during the next 12 months more than 4500 hp. of additional business will probably be added to the company's lines, of which amount 1450 hp. is for the city of Pueblo for water pumping. The balance is divided among the industries of Pueblo, irrigation and power and lighting in the valley districts.

EFFICIENCY IN PUBLIC SERVICE SHOULD BE REWARDED.

Ruling of Illinois Public Utility Commission Points Out Mutual Benefits Should Accrue.

The Illinois Public Utility Commission in a case involving the Monmouth Public Service Co. has made the following statement:

"It would obviously be improper to base rates for utilities service upon a hard and fast rule of the actual expenses of operation and fixed rates of return without regard to the efficiency displayed in the conduct of the business. Such procedure would offer no incentive for improvement and no reward for accomplishment. The public has the right to expect efficiency of operation of utilities engaged in public service and has the right to share in its benefits, but accomplishment merits a tangible and genuine compensation for its achievements."

Operating Practice

Neutral Resistor in Four-Wire Three-Phase Feeders—Locking Circuit-Breakers Open Safely—Welding Trash Racks

REDUCING DAMAGE AND DISTURBANCE DUE TO CABLE BREAKDOWNS ON FOUR-WIRE FEEDERS.

Experience Indicates Correct and Incorrect Location for Current-Limiting Resistor.

When an underground conductor breaks down there are several forms the breakdown may assume. The failure may have occurred between phases, being then a three-phase or single-phase failure, as the case may be; or it may be that the breakdown has taken place between any one phase and the cable sheath.

In cases where the cable is four conductor, serving four-wire three-phase supply, a very common form of cable failure is between any of the three phases and the fourth conductor or neutral. When the former forms of breakdown occur the potential difference at the location of failure just previous to the breakdown is about 4000 volts, with the latter forms of breakdown about 2300 volts.

One operating company having a very large number of four-wire three-phase feeders in use and employing about three hundred induction type feeder regulators, decided to take steps to limit the flow of current in a fault when it occurred. Experimentation showed that there were two aspects to the case, one to limit the current when breakdown occurred between phases or any phase and the neutral conductor, between which exists a pressure of 2300 volts, and the other to limit the current when the breakdown occurred between any phase and the cable sheath. Limiting the current when the breakdown occurred between phases, at 4000-volt potential difference was only a matter of relay adjustment. On the other hand, the setting of the relays for the phase-to-phase failure

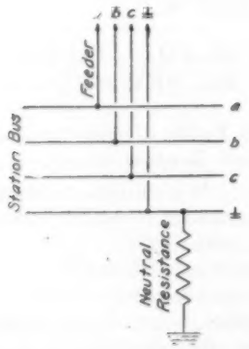


Fig. 1.—Diagram Showing Station Bus, One Four-Wire Feeder and Earthing Resistor.

also was effective for the phase-to-neutral and phase-to-sheath failures.

The circuits of this company has a cross-section corresponding to No. 0 copper; each feeder has a rating of 150 amperes at nominal full load and 4000 volts delta pressure. The relays were adjusted to trip the circuit-breakers instantaneously at 500 amperes, this value having been decided upon as one that would not cause needless service interruptions, and yet would not ordinarily open up transformer banks in the station nor cause excessive disturbance to the station pressure.

At first attempt, a resistance of various values was inserted in the neutral or fourth conductor, between

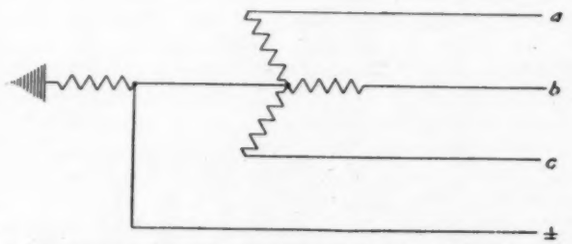


Fig. 2.—Diagram Showing Location of Resistor With Respect to Station Transformer Bank, Neutral Conductor and Transformer Neutral Point and Earth.

the neutral bus and the neutral point of the station transformer banks. With this arrangement, all current passing through the neutral conductor passed through the neutral resistor, causing voltage unbalance, the magnitude of which increased as the current in the neutral conductor increased, which it does as the unbalance in the various circuits increases. This unbalance not only interferred with voltage regulation, but made parallel operation of static transformers on the 60-cycle system with frequency-changers operated from a 25-cycle system almost impossible at times.

The position of the neutral resistor was then changed, as shown in the accompanying diagrams, so that instead of being inserted in the system neutral between the neutral bus and the neutral point of the station transformer banks, it was in circuit between the neutral point of the transformers and the ground. In this way the normal current flowing in the feeder neutrals back to the transformer neutral point was not affected at all, but only that current which flowed through earth back to the transformer neutral. Current can only so flow when a phase conductor breaks down to the cable sheath, because the neutral conductor is earthed at only one place, namely, the station, and then through the resistor; likewise the cable sheaths of the various feeders are rigidly grounded at the station, at various manholes through bonds, and more or less through their contact with the duct line, water, etc.

The accompanying diagrams indicate the final scheme of connections. Fig. 1 shows the station 4-wire bus, one 4-wire feeder and the grounding resistor. Fig. 2 shows the station transformer bank, the neutral resistor and its location with respect to the transformer and feeder neutrals. The resistance

eventually adopted has a resistance of 0.8 ohms, a value that was found to suffice for limiting the magnitude of current rushes in time of trouble, yet not sufficient to raise to a dangerous value the potential above earth of the transformer or feeder neutrals.

The location of the resistor, as shown, does not affect the current rush when a cable breaks down between phases or between any phase and neutral. But it does limit the current when a failure occurs between phase and cable sheath, hence reduces the damage done to the cable and disturbance caused the system. The effect of this location is to lessen the current rush that previously occurred when an overhead phase wire supplied through an underground conductor fell to ground.

MECHANICAL BLOCKS FOR BLOCKING DIFFERENT TYPES OF OIL SWITCHES.

Forms Employed by Philadelphia Electric Co. to Enforce Safety.

The Philadelphia Electric Co. has spared no effort and thought to make conditions safe for its employes and the public. Many ingenious methods and devices have been evolved by which the hazards of electricity have been reduced so that accidents can be prevented. In the operation of its circuits and machines, the company has adopted several precautions to accomplish the same thing, increasing thereby the factor of safety.

In the manipulation of oil current-breakers the company not only compels tags or cards to be placed,

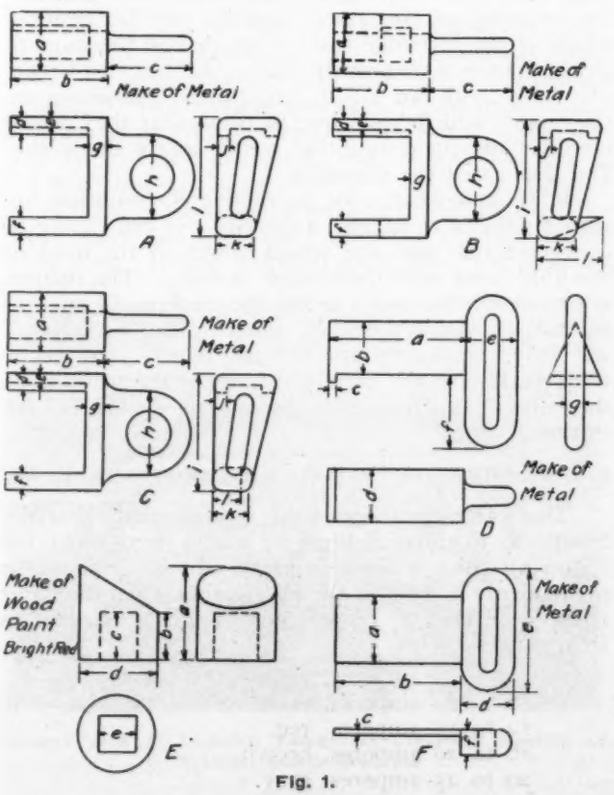


Fig. 1.

stating why and for whom and by whom a circuit-breaker is opened, but it also employs a green light to indicate at the circuit breaker when it is open, in addition to the usual pilot lights on the switchboard. As a further precaution to prevent a circuit-breaker being inadvertently closed, the company uses blocks so that once a circuit breaker is opened it cannot be closed again until these blocks have been deliberately removed. Removing these blocks must be a deliberate act, their design being such that they cannot fall out

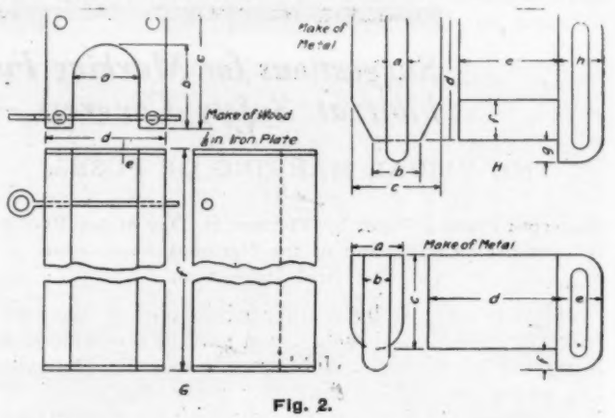


Fig. 2.

of position by vibration, accident, or any other inadvertent cause.

Different types of circuit breakers require different forms of blocks.

Figs. 1 and 2 show the different forms of blocks employed by the Philadelphia Electric Co. The different blocks have been made for the different forms of circuit breakers as shown in the accompanying tabulation:

Block specification.	Type of Circuit-breaker.
A	G. E. Co.'s K5.
B	G. E. Co.'s K5.
C	G. E. Co.'s remote control lever type.
D	G. E. Co.'s K5.
E	Conduit oil switch.
F	Conduit oil switch.
G	G. E. Co.'s H2, H3 and H6.
H	Westinghouse Type B.
I	Westinghouse starting switch.

The above mechanical blocks were described, as were also many other phases of the safety movement as carried on by the Philadelphia Electric Co., in a paper entitled "Tagging, Barriers, Markings and Practices of Operators" presented before a recent meeting of the National Safety Congress at Cleveland by Walter C. Wagner.

WELDING OF CORRODED TRASH RACKS PROVES ECONOMICAL.

Electric Welding Preferred to Other Forms of Welding in Georgia Hydroelectric Plant.

Because of corrosion that had taken place, it became necessary to renew the trash racks protecting seven water turbines at the Morgan Falls hydroelectric plant of the Georgia Railway & Power Co. Altogether seven trash racks required being rebuilt.

The manner of making repairs consisted of cutting off all the corroded bars, in fact all bars, and welding new bars in their place. The welding was done electrically, energy being obtained from the station, of course. The company has found that electric welding is cheaper and less troublesome for work under existing conditions than welding by oxy-acetylene.

Where oxy-acetylene is used, transportation, storage and handling precautions have to be taken which are absent when using electricity.

Contracting-Construction

Suggestions for Marking Fuses — Industrial Lighting Exhibit at Safety Congress — Tennessee Contractors Meet

THE VISUAL MARKING OF FUSES.

Excerpts From a Paper by Thomas H. Day at the Reconstruction Convention of the National Association of Electrical Inspectors.

If necessity is the mother of invention, then the fuses in an electrical installation may be considered as being one of its many children. We cannot consider any phase of applied electricity more important and the evolution of which is fraught with greater interest and more perplexities than the fuses of today.

The final inspection of an installation is frequently made after it is connected to the electric supply and its complete equipment in operation. The inspector is concerned as to the sizes of the several conductors for a given amount of current, and the rated capacity of the fuses installed to protect the conductors and the equipment to which they are connected.

That his final certificate of approval may be accepted as something more than a mere piece of paper, he makes a conscientious effort to examine the visual markings on the fuses. The equipment, power or light, or possibly both, is in use, and to remove each fuse from the cutouts, which he must do so that his inspection may be complete and intelligent, brings a vigorous objection from the manager or superintendent of the plant, building or store, because of the shutdown, even if it be of only short duration.

Difficulty of Reading Fuse Ratings.

This is one of the perplexing experiences of the field, it frequently being impossible for an inspector to quickly ascertain the markings of the rated capacity of fuses. There is no reason for it, but it is nevertheless true that the labels on cartridge fuses of a rated capacity of 30 amperes or less are most frequently on the under side of the fuse when installed. An examination of almost any cabinet will make any one recognize the difficulty of the inspector when he endeavors to ascertain the rated capacity of cartridge fuses.

Emphasis should be laid on the possibility of shock when one is standing on grounded conducting material, or from contact, through the hand and arm, with the side of a metal cabinet which is grounded, in which fuses under examination are installed. The ferrules of some makes of cartridge fuses are secured to the fiber tubing by means of small round-headed pins which project beyond the ferrules. Endeavoring to ascertain the rated capacity of the fuse, the printed label of which was on the under side of the fuse, I have turned the fuse around and, in so doing, have spread the opening between the two clips of the cutout base, thus making a poor contact with the fuse ferrules.

While the personal accident hazard is not so great with the inspection of installed plug fuses, the difficulty in reading the rated capacity with, perhaps, but three exceptions, is readily apparent. Some of the manufacturers are greatly concerned in taking up the greater part of the top of the fuse cup with an announcement of their patent rights, date of granting, etc. This is their legal right, against which it would be unwise to object. The exercise of this right, however, renders it extremely difficult for the inspector to ascertain the rated capacity without removing the fuse from the cutout base. Still, the inspector feels that he should know, while the plant superintendent refuses to have his operations disturbed and instructs the inspector to call after the plant has ceased operations. The temptation to make an incomplete inspection presses down heavily upon the human side of the inspector and who shall blame him if the fuses are not examined.

If I am correct in my analysis of the present requirements for the marking of fuses, there would then seem to be no opportunity for criticising the present practice of the manufacturers. The willingness of the manufacturers to come abreast of the needs of the day is manifest and their present markings on the plug fuses, bewildering as they sometimes are, and the printing of the rated capacity on the required labels of the cartridge fuses, even though the most of the labels are on the under side of the fuses and readable only with an effort, are purely gratuitous on their part, which leads one to think that they would consider any suggestion that would benefit the science and thus assist the inspector.

It is somewhat easy to outline a condition but rather difficult to suggest a remedy. It can hardly be conceived that any one would object to the need of marking fuses with their rated capacity. The opinion is expressed that many desire the marking be such as to make it visual whenever the fuse can be seen. I seriously question the use of small figures stamped on the ferrulese of the cartridge fuses or the printing of the capacity on the labels, because labels do fall off in time.

Color Scheme to Distinguish Capacity of Fuses.

That cartridge fuses of the several rated capacities from 0 to 30 amperes might be readily recognized, the following color scheme is proposed, the color to be permanently applied to the fiber casing when the latter is in the making. These colors might be applied as follows:

0 to 6 amperes, yellow.
8 to 10 amperes, black.
12 to 15 amperes, red.
16 to 20 amperes, brown.
20 to 25 amperes, gray.
25 to 30 amperes, green.

For cartridge fuses from 31 to 60 amperes a similar color scheme could easily be evolved, the difference between terminals indicating that the fuses belonged to the second classification. For cartridge

fuses of great capacities there is not the same difficulty of identifying them and the present method of marking would seem adequate.

The color scheme would not work so well with plug fuses, although the vacant center of the top of the fuse could be marked with the selected color for its capacity. In the absence of a color, it is suggested that the rated capacity of the plug fuses appear in large figures in the center of the top, similar to the method adopted by at least three makers of plug fuses.

While there is an element of personal accident hazard in examining fuses which are in use, indistinct markings will hardly introduce a fire hazard. Overfused wires will create a fire hazard but we have not endeavored to contest that fundamental. If we are facing a possible personal accident hazard when examining the fuses in an installation, should it be the function of the standards in the National Electrical Code to reach out and correct such possibility, more especially when it is becoming so difficult for an inspector to separate the two hazards when applying the principles of the Code?

It cannot be claimed that the above will solve the problem completely, but bringing up the subject and suggesting a possible solution may lead to clearing up the situation.

PREVENTING ACCIDENTS WITH GOOD INDUSTRIAL LIGHTING.

Exhibit at Cleveland Meeting of National Safety Congress Shows Value of Good Lighting in the Prevention of Industrial Accidents.

"Twenty-four per cent of 91,000 accidents analyzed by the Travelers Insurance Co. of America have been shown to be directly or indirectly due to inadequate lighting." With these figures in mind, the most prominent space in Grays' Armory, Cleveland, where the National Safety Congress Exhibition was held during the week ending Oct. 4, was set aside for a "lighting for safety" exhibit. This demonstration occupied the entire stage and overlooked all other exhibits on the main floor. It was arranged under the joint auspices

General View of Lighting Exhibit at Cleveland Meeting of National Safety Congress.

of the Edison Lamp Works of General Electric Co. and the National Lamp Works of General Electric Co.

Appreciating the effectiveness of contrasting lighting conditions in bringing out the value of "better lighting," the exhibitors modelled the display after the N. E. L. A. exhibit at Atlantic City earlier in the year, which was described in the July 12 issue of ELECTRICAL REVIEW. Three systems of lighting were installed to show poor lighting, fair lighting and very good lighting. The poor lighting system consisted of bare lamps on drop cords, so commonly found in small shops. The fair lighting system, such as installed

Exhibit of Industrial Lighting Which Showed Contrast Between Good and Poor Lighting.

by the individual who realizes the necessity for better light but who does not know how to get it, consisted of a combination of general illumination and localized lighting using enameled bowl reflectors. The third system of very good lighting consisted of standard RLM dome reflectors equipped with "C" lamps with opal cap diffusers and bowl-frosted lamps, giving general illumination of good quality and productive intensity.

An interior view of the "shop lighting" room is shown in an accompanying illustration. Each lighting system was on a separate circuit with an automatic switching device which alternately connected each system for a short period, thus making an effective contrast and showing to advantage the value of better lighting.

Supplementing this feature on shop lighting was an educational room showing the latest developments in factory, office and home lighting units. Due to its scope, the lighting exhibit created much general interest. It brought before the safety engineers in attendance at the show the fact that good lighting in a shop or factory is very effective in reducing the number of accidents as well as in increasing the productiveness of the workmen.

TENNESSEE ELECTRICAL CONTRACTORS MEET AT MEMPHIS.

With 65 electrical contractors from Tennessee and adjoining states in attendance, the tenth annual convention of the Tennessee Electrical Contractors' Association was opened last week at the Hotel Gayoso, Memphis, with S. P. Watson, president, in the chair.

The convention was addressed by Samuel A. Chase, Westinghouse Electric & Manufacturing Co., on "Modern Practices in Electrical Merchandising"; J. A. Fowler, Memphis, secretary of the association, on "The Electrical Contractor and the Club Plan of Selling"; W. R. Herstein, Memphis, on "The Jobbers' Job," and William L. Goodwin, General Electric Co., on "Live and Let Live."

New Appliances

Sprague Electric Works Brings Out New Line of Dead-Front Panelboards and Cabinets — New Soldering Stick

New Design of Safety Panelboards and Cabinets.

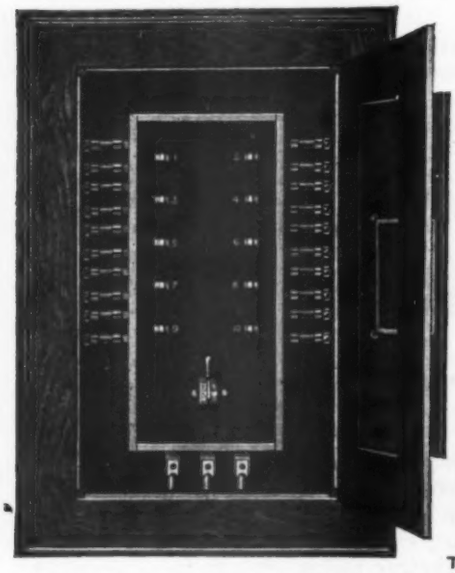
To meet the increasing demand for devices providing for a maximum amount of safety to the operator, the Sprague Electric Works of General Electric Co., 527 West 34th street, New York City, has developed a new line of panelboards which are designed to be applicable wherever the live-front type of panelboards has heretofore been used.

The distinctive features of these panelboards are the branch circuit switches and the main switches, both types of which are simple in design, of strong construction and positive in action. They were designed especially for safety panelboard use. The accompanying illustration shows the type of tumbler switch used for the branch circuits. The blades of these switches make direct contact with the branch connection bars and the brushes of the main switches make direct connection with the main buses, providing a minimum number of electrical joints. The main switches are of the laminated brush contact design, with the toggle locks and with non-retardable, quick-break, double-break action. The brushes are of curved construction, providing a wiping contact when closed, and are designed similar to circuit-breaker brushes. A secondary contact tip and removable control plate is provided for each contact to prevent burning of the main brush. All steel parts used are galvanized to prevent corrosion. The branch circuit switches are rated at 30 amperes, 125 volts, and are of the two-pole tumbler type, with indicating molded handle and of quick-made and quick-break design.

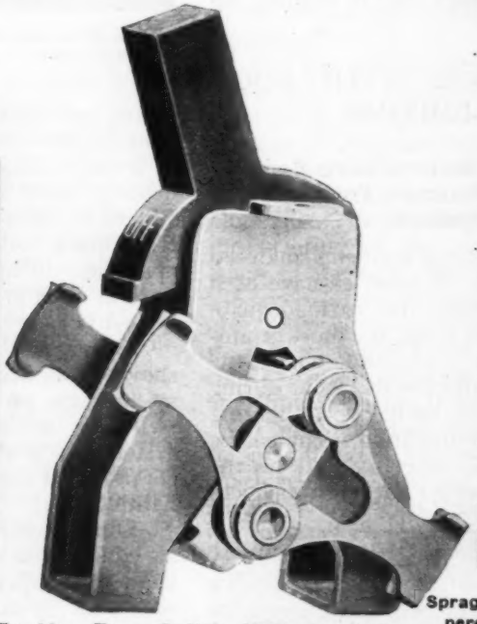
Fuses are placed between the switch and outgoing circuit, and consequently the switch and fuses are dead when the switch is open. The manufacturer also makes this panelboard with plug fuses in branches between the main bars and the branch switches.

Parts which are subject to wear are removable from the front of the panel and can be replaced without adjustment. The panelboards are manufactured to meet the requirements of the National Board of Fire Underwriters.

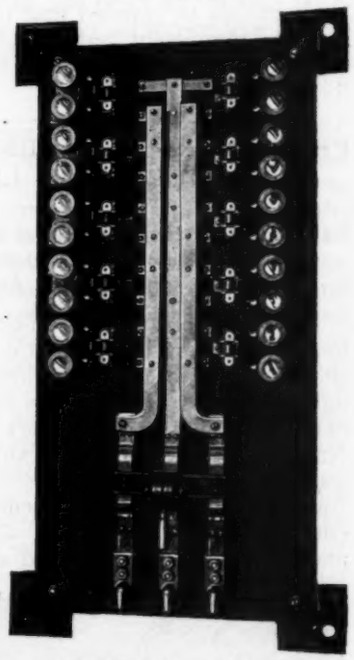
The line of cabinets is made of No. 14 U. S. gage sheet steel with doors and trims of No. 12 gage sheet steel, except boxes over 48 ins. in height which are made of No. 10 gage sheet steel with doors and trims of the same thickness. Doors are furnished with rabbet and substantial flush butt hinges. Doors 48 ins. in height and over have a three-way catch. Cabinets are furnished with one row of ½-in. conduit knockouts, top and bottom, or may be drilled for conduit. Cabinets for panelboards with plug fuses in the branches, with main plugs or unfused main switch, have a single door opening over the entire panel, this door being equipped with a spring catch. Cabinets for panelboards with N. E. C. inclosed fuses in the branches have a door covering the entire panel and a small door hinged on this door to cover the compartment containing the operating handles of branch switches and main switch. The large door is equipped with a combination lock and catch and the small door with a spring catch only. Cabinets for panels with plug fuses in the branches, with main fuses or with fused main switch, have one door equipped with spring catch covering the compartment containing the branch switches, main switch and branch fuses, and a separate door equipped with a combination lock and catch covering the main fuses. Boxes, doors and trims for these cabinets are finished inside and outside with black enamel.



New Type of Sprague Safety Panelboard.



Tumbler Type Switch Used on New Type of Sprague Safety Panelboard.



Sprague Safety Panelboard with 30-Ampere, Tumbler Switches in Branches Arranged for Plug Fuses Outside of Switches.

New Soldering Stick Combines Solder and Flux.

The firm of Hess & Son, 2910 North Sixteenth street, Philadelphia, Pa., has recently developed a new soldering stick known as the Tinol tinning stick. It is a new form of solder and flux combined; when the stick begins to melt it deposits a film of tin which enables the solder to flow freely. This has the advantage of not only fluxing the surface to be soldered, but tinning it as well. This feature enables any one to make a perfect solder joint without previous tinning, it is said.

This new stick can also be used for tinning all kinds of metal surfaces without the use of solder. The flux contained in the stick is of the same composition as that used in the company's other Tinol fluxes and can be used on all metals without any danger of after corrosion, it is claimed.

Trade Activities

Anderson Electric Specialty Co. Extends Facilities—Hurley Machine Conducts Co-operative Campaign for Dealers

Joseph L. Skeldon Engineering Co., Cleveland and Toledo, Ohio, builder of complete steam, electric and hydraulic plants, announces the appointment of W. N. Brown as sales engineer. Mr. Brown will make his headquarters at Cleveland.

McAlear Manufacturing Co., 1901-7 South Western avenue, Chicago, manufacturer of specialties for all steam heating and power plants, is making distribution of a new catalog (No. 25) covering high-grade and modern steam, water and air specialties for high and low pressure heating and power plants. Another catalog on "25 Years of Know How" dealing with vacuum, vapor and air line heating specialties has also been prepared by the company.

The Trumbull Electric Manufacturing Co., Plainville, Conn., announces the appointment of M. L. Spaulding as manager of its Chicago office, 40 South Clinton street. Mr. Spaulding was formerly a member of the sales force of the Chicago office, having left two years ago to accept a position as general sales manager of one of the large electrical supply jobbers in the Middle West. Mr. Spaulding has been in the electrical business for many years and is widely known among the trade of the Middle West.

Change in Name of Universal Battery Service—Considerable confusion among purchasers has been caused through similarity in trade names of the Universal Battery Service Co., adopted by James B. Shafer, Chicago, dealer in automobile storage batteries, and the Universal Battery Co., the name of a previously established Illinois concern. In order that the general public may not be further deceived and misled, the Federal Trade Commission has ordered the former company to discontinue use of the word "universal" in connection with the manufacture or sale of storage batteries.

Alamo Light Plant & Machinery Co,. Memphis, Tenn., has been organized for the purchase, sale, manufacture and repair of all kinds of machinery, hardware, specialties, electrical supplies and accessories, and for conducting a general merchandise business in wholesale and retail quantities. Offices and warerooms for distributing electric plants and machinery for store lighting have been opened in the McCall building. The territory of this company will embrace Arkansas, north Mississippi, and middle and west Tennessee. L. E. Curtis, of Calhoun City, Miss., is president and general manager; J. R. Runnels, of Memphis, vice-president, and L. G. Milan, Tupelo, Miss., secretary-treasurer.

Sherwin-Williams Co., Cleveland, Ohio, has established an Atlanta division in its arrangement of sales territory, with offices at 52 North Broad street, Atlanta, Ga. The new division includes Georgia, Florida, South Carolina and a portion of North Carolina. Warehouses are maintained by the company in both Atlanta and Savannah.

Anderson Electric Specialty Co., Chicago, in order that it may care for its rapidly expanding business, has leased from the Ilg Electric Ventilating Co., the six and seven-story building, 100x100 ft., at 154-160 Whiting street, Chicago, for 15 years from May 1, 1921. The Anderson company had 3000 sq. ft. of space three years ago, and later moved to its present quarters at 118 South Clinton street, which provide 18,000 sq. ft. This space has proved entirely inadequate and has necessitated the leasing of the Ilg plant, which will provide 75,000 sq. ft.

Edison Storage Battery Co., Orange, N. J., has commenced the quarterly publication of a house organ to be known as "The Grid," whose purpose, in the words of the company, is "to disseminate some sense and a little nonsense among users of storage batteries." The initial number, dated October, comprises 25 pages and is gotten up in an attractive manner. A feature of this edition is an interesting article by Ellwood Hendrick, entitled "The Road to Arcad." Item of interest regarding storage batteries are included, interspersed with choice bits of humor.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued bulletin No. 1104 which has for its subject "Steam Turbine Blading." The design and construction of turbine blading is of prime importance and is a feature to which the Allis-Chalmers organization has devoted much time and thought. Considerable research work has been involved in producing its present efficient and reliable unit, and the manner in which this has been attained is described in detail. It was the aim of the company to devise some means for securing the blades which would largely eliminate the human element and insure uniform accuracy and resulted in its adoption of the swaging method. Further progress has been made in this connection by the Allis-Chalmers Co., which may be briefly summarized as follows: The channel shroud protection, followed by the brazed lacing strip, which it is claimed materially increases the life of the blading; brazing the channel shrouds to the tips of the blades, resulting in blade sections and affording great strength and ability to resist vibration, also the process of casting the foundation rings around the ends of the blades. This, together with its present method of securing channel shrouding to the blades results in a blading construction superior to many. The bulletin is replete with illustrations and present conclusive evidence of the efficiency of the swaging method of blading construction.

Edison Electric Appliance Co., Chicago, advises that in view of the constant need of its distributors for a display which will serve as a more or less permanent background for its window display of appliances, this company will have ready for distribution by Nov. 15 the display illustrated herewith. It consists of a center panel, 23 ins. wide by 30 ins. high, with hinged wing side pieces 15x30 ins.; size over all, 53x30 ins. The center panel has an opening which provides

Window Display for "Hotpoint" Appliances.

a niche with a very substantial floor on which nearly any appliance may be displayed. An ordinary Mazda lamp may be inserted behind the display to illuminate the appliance displayed in the niche. As this company manufactures both the Hotpoint and Edison line of appliances, this display is also available with the name "Edison" shown instead of the name "Hotpoint."

The Hurley Machine Co., Chicago, manufacturer of the well known Thor line of electrical labor-saving devices, is conducting a co-operative advertising campaign for the benefit of its dealers throughout the Middle West. The principal feature of this campaign is a series of advertisements to be run in the attractive rotogravure section of the *Chicago Sunday Tribune*. The first of this series appeared on Oct. 19 and will continue to appear until Dec. 17. Another series of advertisements similar to the *Tribune* also has been prepared for use by dealers of Thor appliances in towns reached by this paper. These are specially arranged to tie in with the former advertisements. Two portfolios, one containing the *Tribune* ads and the other the dealer's advertisements, have been distributed in order that all Thor dealers may have sufficient time to make the necessary arrangements for newspaper space, etc.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Lewiston, Me.—Work has been started upon an additional development at the Deer Rips power station of the Androscoggin Electric Co., which will increase the available horsepower by 2500, making a total development at this plant of approximately 8500 hp. of electrical energy available for the needs of Lewiston and Auburn. The cost of this development will be $200,000.

Belchertown, Mass.—The Commission on Mental Diseases, State House, Boston, has taken bids on miscellaneous contracts in connection with the construction of the local hospital building to be located on the Boston & Maine Railroad. The new institution is estimated to cost $500,000, and large quantities of electrical equipment will be required in connection with its erection. Kendall, Taylor & Co., 93 Federal street, Boston, is architect.

Worcester, Mass. — Worcester Pressed Steel Co. plans the erection of a one-story, 90x150-ft. storage building to be equipped with an electric traveling crane.

Lewiston, N. Y.—Plans are under consideration by the town council for improvements in the electric street-lighting system. Service to be furnished by the Lewiston & Lake Shore Power Co.

New York, N. Y.—Import Sales Co., 27 West 20th street, has filed notice with the secretary of state of a change in its corporate name to the Diamond Electrical Specialties Corp.

New York, N. Y.—Western Electric Co. has completed negotiations for the leasing of the entire second floor of the building at 141-45 West 17th street.

Port Henry, N. Y.—Port Henry Light, Heat & Power Co. is considering plans for the construction of a large local hydroelectric power plant, estimated to cost $150,000. The company has filed notice with the secretary of state of an increase in its capitalization from $150,000 to $350,000.

Salamanca, N. Y.—About $5000 will be expended to extend the electric light system.

Elizabeth, N. J.—In connection with the proposed local plant of the Willys-Overland Corp., to be located at Newark and Frelinghuysen avenues, preliminary plans are being prepared for the construction of a large power plant to be used for general factory operation. The proposed plant will comprise a group of buildings, including main manufacturing structure and assembly works, 4-story, steel and reinforced concrete, about 120x440 ft.; four-story and basement stock building, 320x400 ft., a number of shop buildings, one and two-story, with power plant, as well as other small auxiliary structures. Considerable electrical equipment will also be required throughout the entire works, including motors for individual drive, mechanical equipment, etc. The project is estimated to cost $1,000,000. The company maintains offices at 52 Vanderbilt avenue, New York.

Kearny, N. J.—Ford Motor Co. is having plans prepared for the construction of a one-story brick and steel power and heating plant, about 140x160 ft., at its local assembly works. The structure will cost about $150,000, including equipment installation.

Newark, N. J.—Kaltenbach & Stevens, Inc., has awarded a contract to Frederick Kilgus, Inc., 13 South 6th street, for the erection of a new one-story power plant, about 47x75 ft., at 46-56 Bigelow avenue. Plans have also been arranged for the construction of a garage building on the site, the entire work being estimated to cost $35,000.

Newark, N. J.—In connection with the construction of the proposed laundry plant of the New York Linen Supply & Laundry Co., 232 East 32nd street, New York, to be located on High street, Newark, extending to Summer avenue, considerable new electrical and mechanical equipment will be required. The works will cost about $45,000.

Newark, N. J.—Holophane Co., 340 Madison avenue, New York, has developed plans for extensions in its lighting survey work in different cities of New Jersey. The activities include broad investigations of industrial plants and public buildings, with view to increasing the efficiency of the lighting installation.

Newark, N. J.—Colonial Stamping Co., 63 New Jersey Railroad avenue, has had plans prepared for the construction of a new one-story brick boiler plant addition, about 25x32 ft., to be located at the foot of Brill street. Frederick Nobbe, 142 Market street, is architect for the company.

West Long Branch, N. J.—Western Electric Co. has recently completed negotiations for the leasing of property on Whalepond road, and has started the construction of a large wireless plant, estimated to cost in excess of $400,000.

Cheltenham, Pa.—Town council is understood to have completed arrangements for the installation of an electric street lighting system on the Old York road.

Jenkintown, Pa.—Town council is said to be considering plans for the installation of an electric street lighting system.

Johnstown, Pa.—Penn Public Service Co. will issue $20,000,000 of bonds for improvements. Thus far the construction of a large power house in Johnstown is the only improvement planned, but others will follow soon. The Penn Public Service Co. now furnishes power to Cambria, Somerset, Indiana and Westmoreland counties. Extensions throughout the present districts are contemplated and when these are completed it will make the local company one of the largest in the state. Address General Manager P. J. Morrissey.

North Catasauqua, Pa.—Borough council is considering arrangements for the installation of an electric street lighting system throughout the municipality, power to be furnished by the Lehigh Valley Light & Power Co. It is understood that the plans call for the completion of the work by the middle of December.

Philadelphia, Pa.—City has awarded a contract to the Ames Iron Works, Commercial Trust building, with works at Oswego, N. Y., for the furnishing and installation of four turbocentrifugal pumping units at the Queen Lane pumping station of the city waterworks plant, at $127,390. The new units will have a capacity of 40,000,000 gals. of water per 24 hrs.

Philadelphia, Pa. — Breyer Ice Cream Co. has awarded a contract for the construction of a one-story brick boiler plant, about 49x78 ft., to be located at Eighth and Cadwallader streets. The structure is estimated to cost $10,000. William F. Koelle & Co., 26th and Oxford streets, are the contractors.

Smethport, Pa.—M. S. Geary desires data and prices on small plant for light and power.

Wilmington, Del.—In connection with the construction of the municipal paving plant located on Thatcher street, between 12th street and Brandywine creek, the city has arranged for the immediate installation of the necessary boiler equipment for operation.

Baltimore, Md.—Consolidated Gas, Electric Light & Power Co. has completed plans for alterations and improvements in its buildings at 22-30 South Eutaw street and at 1050-90 Front street.

Federalsburg, Md.—Eastern Shore Gas & Electric Co. has recently completed work on the rebuilding of its lines between Federalsburg and East New Market, changing it from a single-phase to a 3-phase system, to provide for increased operations. The company has arranged for the purcase of property on the state road,

near the city limits, and is planning to utilize the site for the construction of a new outdoor substation. In connection with the expansion plans of the company, work is being pushed on the installation of considerable additional equipment at its Hurlock and East New Market stations.

Ocean City, Md.—Charles A. McCregor desires prices on electrical equipment.

Martinsburg, W. Va.—Fire, originating in the boiler and engine plant of the C. H. Whiting Milling Co. works at Shepherdstown, near Martinsburg, completely destroyed the plant, with a total loss estimated at approximately $125,000.

Lenoir, N. C.—Falls Manufacturing Co., Granite Falls, will establish an additional hydroelectric plant. It will be located on Middle Little river, about two miles from Granite Falls. The plan calls for a dam 54 ft. in height, and will cost about $40,000. A two-mile transmission line is to be built to connect with the present line, making the total distance 12 miles and the total cost $65,000. The new plant will generate about 600 hp.

Denmark, S. C.—Edison Public Service Co. contemplates increasing the capacity of its lighting plants.

Atlanta, Ga.—Thomas F. Seitzinger's Sons, operating a local foundry, are considering plans for the rebuilding of their works, including boiler plant, recently destroyed by fire, located at North avenue and Marietta street.

Columbus, Ga.—It is proposed to install at the Goat Rock station of the Columbus Power Co. an 8000-hp. horizontal water wheel with direct connected 6250-kv-a., 500-kw. generator, complete, with penstock, electrically operated headgate and switchboard extension. A new 11,000-volt transmission line will be constructed from Goat Rock to Columbus, about 11 miles. The line is to be insulated and spaced for 33,000 volts. Estimated cost, $358,000. G. F. Harley, constructing superintendent. Stone & Webster Engineering Corp. will be in charge of the work.

Homestead, Fla.—The city plans to enlarge the capacity of its electric light and water plant. An issue of $15,000 has been voted for the purpose.

Tampa, Fla.—Peninsular Telephone Co. will improve the lines at Ybor City and Seminole Heights. Address W. G. Brobein, president.

NORTH CENTRAL STATES.

Berea, Ohio—At the November election the question of issuing $48,000 in bonds for the construction of a municipal light plant will be submitted to vote. Address city clerk.

Chillicothe, Ohio—Plans have been completed by officials of the Chillicothe Railway, Power & Light Co. for extensive improvements to their plant in this city.

Independence, Ohio—At the November election the question of issuing $20,000 in bonds for a municipal light plant will be submitted to vote. Address city clerk.

DATES AHEAD.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Eli C. Bennett, St. Louis, Mo.

Electrical Supply Jobbers' Association. Semi-annual meeting, Cleveland, Ohio, Nov. 18-20. Headquarters, Hotel Cleveland. Secretary, Franklin Overbagh, 400 South Clinton street, Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Minerva, Ohio—Engineers Froelich & Emery, Second National Bank building, Toledo, Ohio, are preparing plans for erecting a $50,000 power plant and distributing station for the village of Minerva. Specifications include brick and concrete construction, plumbing, electric lighting and composition roofing. Address H. A. Pennoth, manager, Minerva, Ohio.

Hillsdale, Mich. — Alamo Farm Light Co., manufacturer of farm lighting outfits, is enlarging its present plant by an addition, 200x240 ft. Contract has been awarded to the Austin Co., Cleveland.

Garrett, Ind.—Important changes in the management and maintenance of the municipal light, water and steam heating plans will be made, following recommendations of the Indiana Public Service Commission. The company will probably purchase new equipment consisting of a boiler and connections, employ a manager with complete authority to operate the plant and place all service on a meter basis.

Wabash, Ind.—Service Motor Truck Co. will begin work at once on a new building, 75x775 ft., to cost $150,000.

Chicago, Ill.—Apex Appliance Co. will erect a two-story plant to cost $135,000.

Chicago, Ill.—Chicago Electric Manufacturing Co., 2811 South Halsted street, will build a two-story plant, 100x133 ft., to cost $60,000. E. S. Preston, president.

Chicago, Ill.—Electric Machinery Equipment Co., 714 West Van Buren street, plans to install a 50 to 75-kw., 440-volt, 60-cycle, 3-phase, direct connected unit.

Jacksonville, Ill.—Jacksonville has voted to issue bonds in the sum of $210,000 to pay off the floating indebtedness, build a filtration plant and remodel the municipal lighting plant.

Peoria, Ill.—Central Union Telephone Co. will erect four-story telephone exchange building to be ready for occupancy July 1, 1920.

Urbana, Ill.—A contract for the installation of two 500-hp. boilers in the new power plant of the University of Illinois has been let to the Lacelede-Christy Boiler Co., St. Louis, Mo. Complete installation is expected by Dec. 15. At present the four new boilers in the new power house are being used in connection with the two old ones in the old power house. When the two new boilers are installed only the new plant will be used. The new boilers will increase the capacity of the plant 50%.

La Crosse, Wis.—Architect J. R. Law, Strand Theater building, Madison, Wis., is preparing plans and will let the contract for erecting a $150,000 power house and office building for the P. Lourland Co., La Crosse, Wis. Specifications include power house equipment, steam heating, plumbing and brick construction. The building will be 50x300 ft.

Osseo, Wis.—Augusta Light & Telephone Co. has taken over the Osseo electric light plant and franchise from J. N. Lee & Son. The new owners will take possession just as soon as the new line can be built from Augusta to Osseo, which will carry light and power from the Wisconsin-Minnesota main line.

Milwaukee, Wis.—Res Manufacturing Co., 2907 Meinecke avenue, is taking bids for a two-story plant addition, 30x75 ft., and is in the market for some new equipment.

Chaska, Minn.—The city council has ordered 3 street lights to be installed on Augusta road. Address J. M. Aretz, city clerk.

Minneapolis, Minn.—The installation of an additional 40,000-hp. steam turbine unit in the Riverside station has been authorized by the board of directors of the Northern States Power Co. The engineering and construction department of H. M. Byllesby & Co. will have charge of the new work.

Montevideo, Minn.—Contract has been secured by the Northern States Power Co. covering the electric energy required for the operation of a grist mill at Sacred Heart, Minn. A 20-hp. motor will be installed at once for feed grinding, and a larger motor will be installed later to operate flour milling machinery.

Red Lake Falls, Minn.—Red River Power Co. will make improvements to the local plant. Specifications include generator, exciter, panel on switchboard and water wheels. Address E. F. Wheeler, manager.

Beatrice, Neb.—Farmers and business men of Rockford, Filley and Virginia have pledged $9000 for the proposed electric line from Holmesville through these three towns.

Plymouth, Neb.—The sum of $21,000 has been raised by business men for a lighting system. The town and local electric company will build a line from Beatrice to this point.

Hankinson, N. D.—H. L. Cotry, of Aberdeen, has completed estimates for a $200,000 light and water system for this town.

Beresford, S. D.—Considerable progress is being made in the construction of a new municipal electric light plant. Poles are being set preparatory to the stringing of wires.

Watertown, S. D.—The city council has authorized the erection of a municipal power plant. Site has been purchased and will be rebuilt for a power plant.

SOUTH CENTRAL STATES.

Louisville, Ky.—Commercial department of the Louisville Gas & Electric Co. during the week ended Oct. 7 secured 62 new electric light and power customers with 43-kw. of lighting and 31 hp. in motors, and took orders for wiring 7 already built houses. New business connected shows an increase of 57 customers with 52 kw. of lighting. There was a temporary loss of 33 hp. in motors. Electric energy output was 12.7% greater than during the same week of 1918. During the week the company and dealers combined sold 79 electric vacuum cleaners, 54 flat irons, 31 washing machines and 54 miscellaneous household appliances.

Carthage, Miss.—Establishment of municipal electric light and light plants is contemplated; Williams & Lebby, engineers, Yazoo City, Miss. Address the mayor.

Pascagoula, Miss. — Pascagoula Street Railway & Power Co. is arranging plans for extensions and improvements in its local light and water plants, to facilitate and increase the present operations.

Broussard, La.—The village has let a contract to A. C. Boyd to furnish a 25-hp. generator for furnishing electric current. The Lafayette Electric Co. will install the wire and erect the poles.

Horatio, Ark.—City council is arranging plans for the installation of an electric light and water works system for municipal service.

Fargo, Okla.—The council contemplates the installation of electric light and water plant. Cost $26,000. Address mayor.

Miami, Okla.—Plans are under consideration by the city council for the installation of an ornamental street lighting system.

Nowata, Okla.—The council will make electric and water work improvements. Burns & McDonell, engineers, Interstate building, Kansas City, have made estimates.

Ochelata, Okla.—An election will be held Nov. 4 to vote on bonds for the building of a water works system and an electric light plant in that city. The water works system will cost about $13,000 and the light plant about $7000.

Sapulpa, Okla.—Sapulpa Electric Co. has closed two-year contract with the Sapulpa Refining Co., covering all its power and light requirements. The connected load is estimated at 225 hp. motors.

Tulsa, Okla.—Oklahoma Gas & Electric Co., Oklahoma City, contemplates the extension of its electric transmission lines from Kiefer to Bixby to Jenks. Estimated cost, $70,000.

Dallas, Tex.—E. P. Turner, of Dallas, and associates plan to construct an interurban electric railway between Ranger and Eastland, as a part of a through line that is planned to run between Dallas and Abilene, about 175 miles.

Dallas, Tex.—Burt C. Blanton, of Dallas, and associates are promoting the construction of an interurban electric railway between Sherman and Whitesboro, with branch line to Gainesville and possibly a number of other towns of North Texas. It is stated that the proposed road is to be financed by Eastern men. The project involves the construction of an electric power station.

Fort Worth, Tex.—Fort Worth Light & Power Co. is installing new boilers and other equipment in its plant at a cost of $135,000.

San Antonio, Tex.—The commissioners court of Bexar county has granted a permit to Lieut.-Col. F. G. Chamberlain, construction quartermaster at Camp Travis, to build a high-tension electric transmission line from San Antonio to Camp Stanley and Leon Springs, 18 miles, for the purpose of supplying these places with light and power.

San Augustine, Tex.—Plans are under consideration by the city council for the purchase of the local electric light plant, to be converted to municipal service. It is understood that extensive improvements and alterations will be made to facilitate operations.

Wichita Falls, Tex.—Wichita Falls Electric Co. will improve the central power station and enlarge the transmission lines. Furnish electric power to Burkburnett district and will purchase engine.

WESTERN STATES.

Livingston, Mont.—Western Power Smelting Co., owning extensively developed copper properties and a 250-ton copper matting plant that is almost completed at Cook county, has commenced the survey of the route for its electric power transmission line, a distance of four miles from its completed power plants to the smelters and mines.

Thermopolis, Wyo.—Hot Springs Light & Power Co. has sold the plant supplying Thermopolis with electricity to M. Singer and B. V. Hole, representing a New York concern. The new owners of the plant will at once reconstruct it, adding machinery required to give better light and power service to Thermopolis.

Seattle, Wash.—A steel pump and power house, 16x64 ft., will be constructed by the Petroleum Co. at 1710 16th avenue.

Richmond, Cal.—Western States Gas & Electric Co. has closed contract with the California Wine Association for 150 hp. in motors for the Fresno Cooperage Co., which is establishing a plant at Richmond to employ about 200 men.

Sespe, Cal.—Sespe Light & Water Co. proposes to develop 35,000 hp. electric energy for irrigating purposes. Address Frank Buren, president.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Boiler-House Machinery, Etc. (30,856).—The electrical commissioners of a city in Australia desire to receive quotations and full information for the purchase of boiler-house machinery, including boilers, economizers, etc.; coal and ash handling machinery; coal-mining machinery; turbogenerators; condensing plants; electrical storage batteries; machine tools; traveling cranes, electrical instruments; switch gear; switches and all accessories; synchronous condensers; water turbines for direct coupling to generators; briquetting machinery; gas producers; and coal-pulverizing machinery. Description of machinery and equipment required may be had on application to the bureau or its district offices.

Railway Equipment (30,918).—Material and equipment for a railway to be built in one of the Scandanavian countries, including construction machinery, rails, rolling stock, etc. Locomotive power may be steam or electrical traction (probably the latter). Track and rolling stock will be standard gauge (1.435 meter). Information, description, illustrations, etc., are earnestly desired. Reference.

Electrical Goods (30,932).—An engineer in Italy desires to secure an agency for the sale of mechanical and electrical goods and industrial chemical products. Correspondence may be in English. References.

Power Equipment (30,939).—The English representatives of a worsted spinning firm in Poland desire to purchase scouring, carding, combing, drawing, twisting, and spinning machinery for short and medium wools; also motive power machinery, boilers (Lancashire and tubular for steam raising 240°), engines and turbines for a 2000-hp. plant. This machinery is needed for the reconstruction of mills in devastated regions formerly occupied by the enemy. Reference. Further information may be had upon application to the Bureau or its district offices.

Engineering Supplies (30,964).—A Russian civil engineer desires to represent in Latvia (Lettland) American manufacturers of automobiles, typewriters, elevators, engineering supplies, cement, concrete machines, machine tools, etc. Correspondence may be in English. References.

Motors, Pumps (30,966).—The purchase is desired by a manufacturing company in Belgium of motors, 3

phase, 40 cycles, 220 volts; controllers, starters, resistances, distribution tables, transmission equipment, railroad equipment, narrow gauge (60 centimeters); centrifugal pumps, steel cables, steel balls for grinding, lime and cements, and office equipment and supplies. Quotations should be given c. i. f. Antwerp. Correspondence may be in English.

Electrical Fixtures (30,992).—A firm in Norway desires to secure an agency for the sale of automobiles and supplies, tires, engineering and building supplies and equipment, heating furnaces, electrical fixtures, elevators and hoisting machinery, painting and decorating supplies, and brewing machinery. Quotations should be given c. i. f. Norwegian port. Terms, preferably 90 days. Reference.

PROPOSALS

Street Lighting.—Bids will be received by J. A. Fitzgerald, village clerk, Newburgh Heights, Ohio, on Oct. 28, for the lighting of the streets and public highways within the village, in accordance with plans and specifications on file.

Electric Light Plant.—Bids will be received until Nov. 15 by the town council, Vona, Colo., for installing a waterworks system and electric light plant, to cost about $25,000. R. D. Salisbury, 1415 East Colfax avenue, Denver, engineer.

Boiler.—Bids will be received until Oct. 28 by the Treasury Department, Washington, D. C., for installing a 200-hp. water-tube boiler at the Bureau of Engraving and Printing. J. A. Wetmore, supervising architect.

Generator, Motor.—Bids will be received until Oct. 27 at McRae, Ga., for a 90 or 150-kv-a., 3-phase, 60-cycle, 2300-volt engine type alternating current generator with exciter and switchboard; 35 to 40 hp., 3-phase, 60-cycle, 2200-volt slip ring motor with overload relay panel and ammeter. Plans, etc., may be secured from W. H. Singleton, engineer, 915 Chandler building, Atlanta. C. A. Ryals, mayor.

INCORPORATIONS

New York, N. Y.—Build-Craft Electric Manufacturing Co. Capital, $10,000. To manufacture electrical appliances, etc. Incorporators: C. Kriser, F. Sauozuk, and V. J. Lohn, 25 Church street.

New York, N. Y.—Brooks-Harrington, Inc., Capital, $20,000. To manufacture engines, boilers, and kindred equipment. Incorporators: A. S. Marselis, R. E. Brooks, and W. G. Harrington, 50 Church street.

New York, N. Y.—Atlantic States Electric & Supply Co., Inc. Capital, $10,000. To deal in engines, motors, electrical supplies, etc. Incorporators: B. W. Sandback, W. Poklop, and S. Graham, 108 West 95th street.

New York, N. Y.—Radio Bulb Co. Capital, $25,000. To manufacture electric bulbs, reflectors, and kindred specialties. Incorporators: H. H. Walter, G. Boger, and J. H. Taylor, 644 Eighth avenue.

New York, N. Y.—DeMatteis Boiler System Co. Active capital, $24,000. To manufacture boilers, etc. Incorporators: E. Fasani, A. DeMatteis, and C. L. Zucca, 118 West 49th street.

New York, N. Y.—The Talty Corp. Capital, $50,000. To engage in a general electrical engineering and contracting capacity. Incorporators: J. J. Alexander, I. B. Canfield, and T. W. Burke, 240 Riverside drive.

New York, N. Y.—Solar Light Corp. Incorporated under Delaware laws with a capital of $10,000,000. To manufacture gas arc lights and electric and gas fixtures, etc. Incorporators: Cornelius A. Cole, Hackensack, N. J.; Arthur R. Oakley, and Robert A. Van Voorhis, New York.

New York, N. Y.—Stander-Lindenbaum Co. Capital, $20,000. To manufacture electric and gas fixtures, etc. Incorporators: P. Lindenbaum, and B. and L. E. Stander, 819 Hunts Point avenue, New York.

Syracuse, N. Y.—Onondaga Auto Electric Service, Inc. Capital, $75,000. To manufacture electric apparatus, automobile accessories, etc. Incorporators: W. H. Craig, W. N. Henderson, and J. M. Dunne, 704 Midland avenue.

Newark, N. J.—Newark Armature Works, Inc. Capital, $15,000. To manufacture electrical specialties, etc. Incorporators: Fictor A. Rohner, Adolph W. Sherriff, and James K. Elderkin.

Baltimore, Md.—Thomas Engineering Co., 211 Key Highway, Capital, $50,000. To engage in a general electrical contracting capacity. Incorporators: M. H. White, Thomas W. Thomas, and Irvin Griggs.

Shull's Mill, N. C.—Boone Blowing Rock Light & Power Co. Capital, $50,000. To operate a local plant for the generation and distribution of electric energy. Incorporators: W. S. Whiting, Shull's Mills; and George P. Hageman, Boone.

Allentown, Pa.—C. M. Walter and associates have incorporated the following electric companies, each with a nominal capital of $5000: Allen Township Electric Co., Northampton; Hanover Township Electric Co., Lehigh; East Penn Township Electric Co., Carbon; Mahoning Township Electric Co., Carbon; Mauch Chunk Township Electric Co., Carbon; North Whitehall Township Electric Co., Lehigh; and Washington Township Electric Co., Lehigh.

Hampton, S. C.—Twin City Light & Power Co. has incorporated with a capital of $30,000. Incorporators: R. H. Gibson and others.

New York, N. Y.—F. W. Billet, J. A. Trimble, and R. A. Barton, 2024 80th street, have incorporated the Syracuse X-Ray Laboratories, Inc., the Utica X-Ray Laboratories, Inc., and the Rochester X-Ray Laboratories, Inc., each with a capital of $10,000, to operate X-ray laboratories, etc.

New York, N. Y.—Horace G. Cooke, Inc. Capital, $100,000. To manufacture exhaustors, pumps, blowers, and kindred equipment. Incorporators: B. N. Bishop, G. P. Breckenridge, and H. G. Cooke, 300 West 109th street.

New York, N. Y.—Fox-Reynolds Co., Inc. Capital, $10,000. To engage in a general electrical contracting capacity, etc. Incorporators: F. L. Reynolds, Henry E. Fox, and Samuel F. Frank, 170 Broadway.

Amenia, N. Y.—Amenia Electric Light & Power Co. Capital, $25,000. To operate in Dutchess county. Incorporators: L. F. Eaton, E. J. Chaffee, and E. B. Thompson.

Newark, N. J.—Niola Electric Manufacturing Co. Capital, $50,000. To manufacture electrical goods. Incorporators: Albert Niola, August B. Gutman and Joseph R. MacLear.

Philadelphia, Pa.—Willys Light & Power Co. Incorporated under Delaware laws with a capital of $250,000. To manufacture light and power appliances, etc. Incorporators: David H., Alfred S., and Alfred Harner Miller, all of Philadelphia.

Washington, D. C.—Washington Electric Co. Incorporated under Delaware laws with a capital of $50,000. To manufacture electrical goods. Incorporators: Charles D. Kenny, Harry Kapneck, and Leonard A. Block, Washington.

Norfolk, Va.—Norfolk Electric Manufacturing Co. Capital, $15,000. To manufacture electrical supplies, etc. Joseph E. Johnson is the principal incorporator.

Charleston, W. Va.—Kalmerten-Warner Electric Co. Capital, $10,000. To manufacture electrical goods. Incorporators: J. A. Herman, D. C. Warner, O. W. Kalmerten, J. E. Hanley, I. W. Belcher, and G. E. Warner, Charleston.

Lynchburg Va.—Neld-Electric Corp. Capital, $25,000. To manufacture electrical specialties. Charles B. Easley is the principal incorporator.

East Alton, Ill.—East Alton Public Service Co., has been incorporated with capital of $25,000 by F. W. Olin, J. M. Olin, and J. L. Donnelley.

Ashley, Ind.—Farmers Light & Power Co. has been incorporated for $10,000 to distribute electric light and power. The directors are I. D. Deller, Walter Mortorff and E. Hissong.

Quincy, Ill.—Quincy Battery & Electrical Testing Co. has been incorporated with capital of $10,000 by Milton E. Breder, Albert W. Henry and Bessie M. Henry.

Hammond, Ind.—Hammond Manufacturing Co. has been incorporated with capital of $75,000 to manufacture and construct machinery. The incorporators are Thomas A. Munro, Harry P. Munro and P. J. Foy.

Indianapolis, Ind.—Milholland Machine Co. has been incorporated with capital of $1,200,000 to manufacture machinery of every kind. Address H. T. Benham.

Personals

F. H. Bethell Becomes Vice-President of White Oil Corp. — U. N. Bethell Retires from Business — Other Changes

C. C. WILCOX, assistant to consulting electrical engineer of Hodenpyle, Hardy & Co., Jackson, Mich., is now chief engineer of the Durant Building Corp.

F. W. LEAHY has resigned from the Emergency Fleet Corp. to assume charge of the marine department of the Diamond Power Specialty Co., Detroit, Mich.

CHARLES D. EMMONS, formerly manager of the Northern Indiana Railway Co., South Bend, Ind., has been made president of the United Railways & Electric Companies, Baltimore, Md.

WIRT J. WILLS, who has been connected with the Memphis Artesian Water Department for over 13 years as chairman of the Commission and general superintendent, has resigned, resignation to take effect Nov. 1. Mr. Wills will devote his entire attention to the manufacture of the "Wills Pumping System" of which he is the patentee.

E. W. WAGENSEIL, engineer of the stoker department, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., on October 20 gave a very instructive address on combustion and an illustrated lecture on mechanical stokers as applied to stationary steam boilers, before the mechanical engineer members of the Duluth Engineers' Club.

CURTIS M. LINDSAY, manager of the advertising and sales promotion department, Edison Electric Appliance Co., Chicago, has resigned to join the McGraw-Hill Publishing Co., New York. Mr. Lindsay is a graduate in electrical engineering of Armour Institute of Technology. After several years with the J. G. White Engineering Corporation, he joined the Hotpoint Electric Heating Co., Ontario, Calif., in 1912. Two years ago he came to the Chicago Hotpoint office.

FRANK H. BETHELL, first vice-president of the New York Telephone Co. and active head of the eastern group of telephone companies of the American Telephone & Telegraph Co., has resigned his office to become vice-president in charge of finances of the White Oil Corp., a new combination of oil interests recently formed by a group of New York bankers. Mr. Bethell has been connected with the Bell system since 1890, when he entered the Newark office of the New York & New Jersey Telephone Co. Some years later he removed to New York, serving in the auditing department of the Metropolitan Telephone & Telegraph Co. In 1899 he became a salesman, and from 1901 to 1904 was contract agent for the New York Telephone Co. In 1904 he was made general manager of the Chesapeake & Potomac Co., and held positions with other companies until 1911, when he became vice-president of the New York Telephone Co.

FRANK TALBOT, Danville, Va., superintendent of local public utilities, has been elected city engineer, to succeed J. O. Magruder.

HARRY C. BUFFINGTON, formerly motor engineer, Minneapolis Steel & Machinery Co., Minneapolis, has accepted the position of chief engineer of the Holt Manufacturing Co., Peoria, Ill.

A. H. KEHOE, for the past eight years connected with the United Electric Light & Power Co., New York City, has been appointed superintendent of transmission and distribution of the company.

H. B. BRYDON, of the engineering department of H. M. Byllesby & Co., Chicago, has been appointed a member of the Prime Movers Committee of the Technical and Hydroelectric Section, National Electric Light Association.

CARLETON A. ORR, formerly connected with the Arkansas Valley Railway, Light & Power Co., Pueblo, Colo., in the capacity of superintendent of power plant and shops, has become associated with the Baker Steam Motor Car & Manufacturing Co., Inc., Pueblo, Colo.

THOMAS A. EDISON, West Orange, N. J., visited New York on Oct. 11 to view a bronze tablet placed at 257 Pearl street in 1917 in commemoration of the building of the New York Edison Co. station at that location in 1882, when electric lights were introduced in New York. It is set forth that upon the unveiling of the tablet two years ago, Mr. Edison was too engrossed in war problems to journey to New York, this being Mr. Edison's first visit to the city during this length of time. On the same day, Mr. Edison attended a luncheon held in honor of Cardinal Mercier at the Waldorf-Astoria Hotel.

J. E. MELLETT, commercial engineer, electrical department of the Georgia Railway & Power Co., Atlanta, Ga., has become associated with the Carter Electric Co., Atlanta, Ga., in an executive capacity. His long experience in public service and his previous technical training in electrical engineering eminently qualify Mr. Mellett for his new position with one of the largest wholesalers and retailers of electrical supplies in the South. Previous to joining the Georgia company, he was manager of the Chattanooga office of the Georgia Power Co., prior to which time he was manager of the General Electric Co.'s branch in the same city.

UNION N. BETHEL, who resigned as senior vice-president of the American Telephone & Telegraph Co., has tendered his resignation as chairman of the board of directors. Mr. Bethell contemplated retiring from business life some time ago, but the war and its resultant claims upon telephone service and telephone experts called him to Washington as chairman of the Operating Board for the operation of the telegraph and telephone service under Government control. He was born in Newburgh, Ind., Sept. 12, 1859, and was graduated from Hanover College. He entered the telephone business about thirty years ago, when the telephone was in its early stage of development, and began his career at Brooklyn with the New York & New Jersey Telephone Co. In a short time he was elected secretary and treasurer of that company, and in 1893 was made general manager of the New York Telephone Co. In 1901 Mr. Bethell was made president of the company operating in Washington, Baltimore and surrounding territory, and later became president of the Philadelphia & Eastern Pennsylvania Co. By successive steps he assumed the management of the companies in New York state, New Jersey, Pennsylvania, Delaware and Maryland. In 1909, these companies, with Mr. Bethell at their head, were formed into an operating unit extending from Washington, D. C., to the Canadian border, and from New York as far west as Pittsburgh. In 1910 he was made vice-president of the American Telephone & Telegraph Co, and later became senior vice-president of that company as well as president of the New York Telephone Co. In December of 1911 he was elected chairman of the board of directors of the Bell system. Mr. Bethell is considered one of the world's leading authorities on questions of telephone policy, finance and management. In 1909, he was decorated with the Order of the Rising Sun by the Emperor of Japan for his services to science. N. C. Kingsbury, senior vice-president of the American Telephone & Telegraph Co., succeeds Mr. Bethell as a director and as a member of the executive committee.

Obituary.

CHARLES FRANKLIN SNYDER, for 14 years superintendent of light, heat and power with the Bloomington & Normal Railway & Light Co., passed away recently at the age of 52 years. Mr. Snyder was born near Saybrook, Ill., Jan. 11, 1867. He began his public service career 28 years ago, entering the service of the old Bloomington Light Co. as arc lamp trimmer, and worked up through the various branches of the business and acquired an intimate knowledge of the power house and lines. By reason of his efficient and faithful service he was rapidly promoted from one position to another until his appointment as superintendent of light, heat and power 14 years ago. Coming into daily contact with people in all walks of life for many years past has given him a wide circle of friends and acquaintances who will regret to learn of his untimely death.

The Second

International Power Economy Conference

will be held at the rooms of the Western Society of Engineers, Monadnock Block,

CHICAGO
October, 30-31

Reports will be presented by Divisional Chairmen and plans outlined for the formation of a permanent organization.

First session will convene at 10:30 A. M., Thursday, October 30, 1919.

Manufacturers of Power Plant Equipment, Fuel Engineers, Producers, Managers of Public Utilities and all others interested in the problems of Fuel Production, Utilization and the Conservation of Fuel Resources are cordially invited to be present.

C. A. TUPPER,
Chairman, International
Power Economy Conference.

Financial News

Foreign Trade Financing.

Termination of government financing for America's foreign commerce and the stimulation of a return to normal business methods through private enterprise have been advocated as necessary steps for solving international trade difficulties by James S. Alexander, president of the National Bank of Commerce in New York, as chairman of the Committee on Credits and Finance of the International Trade Conference. The conference is held under the auspices of the Chamber of Commerce of the United States and is composed of representative business, banking and industrial leaders from all over the country, gathered to discuss Europe's commodity and financial needs with similarly prominent men unofficially representing England, France, Belgium and Italy.

Mr. Alexander declared that another cardinal element in restoring normal conditions is "the necessity of the greatest possible number of people doing a day's work and of the greatest possible conservation of the results of that work." The speaker added:

"In a sense never before so universally applicable, industry and thrift are in this aftermath of war's destruction essential not only to the happiness, but even to the very existence of the human race. Never was an economic proposition more simple and self-evident."

Mr. Alexander said that it was not proposed to offer a cure-all to those engaged in foreign trade and that it would be inadvisable to try to provide a single scheme or special method for financing trade between Europe and America. In advocating a return to normal business methods he pointed out that this did not necessarily mean a return to pre-war conditions since "even in the throes of war the world has conformed to progress and some good has come out of evil times."

The conduct of business, he said, would have to be shaped in accordance with the present and the future, as well as the past, accepting things largely as they are and aiming to adapt them and ourselves to a practical working basis. In discussing the maladjustment in trade relations he pointed out that while a favorable balance of trade of several hundred million dollars a month had been accumulating for the United States, great unfavorable balances of trade had grown against the nations of Europe.

Boston Edison Report Shows Increase in Net and Gross.

The annual report of the Edison Electric Illuminating Co. of Boston for the fiscal year ended June 30, 1919, shows gross earnings of $11,435,709, compared with $9,623,605 for the previous year.

Earnings compare as follows:

	1919.	1918.
Gross	$11,435,709	$9,623,605
Expenses	6,287,731	4,831,270
Net	5,147,977	4,792,335
Miscellaneous profits.	81,507	89,606
Total net	5,229,484	4,881,941
Taxes	1,057,628	938,179
Balance	4,171,856	3,943,762
Interest	1,021,231	705,663
Dividends	2,703,360	2,703,360
Balance for depreciation and miscellaneous charges	447,264	534,739

Charles L. Edgar, president, said in part:

The following table shows the total connected load in kilowats for the last five years:

Total kilowatts connected—	
June 30, 1915	219,440
June 30, 1916	243,337
June 30, 1917	278,051
June 30, 1918	335,198
June 30, 1919	378,332

The increase this year of approximately 43,000 kw., or over 12%, includes 12,500 kw. for the Quartermaster's Terminal in South Boston, a strictly war project, but of the remainder by far the larger part has been added since the signing of the armistice.

The very large increase in gross earnings of $1,812,000 is due not only to the normal increase in business, but to a 10% addition to all bills for electricity, which became effective in December, and to a charge during a portion of the year, based upon the kilowatt hours used by each customer, of an amount equal to the difference between the present cost of coal and the cost under pre-war conditions. These two items alone amount to approximately $1,116,000, leaving $696,000 representing the normal increase in earnings.

Expenses likewise have greatly increased—$1,456,000. The excess cost of coal for the year over pre-war cost amounted to $1,145,000, and is $682,000 more than for the previous year. In order to meet partially the increased cost of living, an increase of 10% in pay of all employes receiving $3000 a year or less was put into effect in May of 1918. This was increased to 25% early in July of 1918, and has been in effect during the remainder of the fiscal year. This item amounts to approximately $450,000. These two items have, therefore, increased the expenses $1,132,000, leaving $324,000 as the normal increase in expenses.

Allis-Chalmers Dividend Outlook.

The Allis-Chalmers Manufacturing Co., from present indications, will earn about $2,600,000, or $10 a share on the common stock this year, after all charges and taxes. The gross is running at the rate of $30,000,000 annually.

The working capital approximates $23,000,000, more than enough to provide for an initial payment on the junior issues, but the directors are conservative. They aim to clean up accumulated preferred dividends before starting disbursements on the common stock. Back dividends on the major issue amount to 1¾%, and this should be paid off this year. There is every reason to expect dividends on the common stock will be started next spring, but interests in the company do not look for more than 1% quarterly.

The company expects to make a satisfactory showing from the tractor end of the business next year. This is a new venture for the Allis-Chalmers, although the company has been working on the proposition for something like three years.

Dividends.

A quarterly dividend of $2.50 a share has been declared by the Lowell Electric Light Corp., payable Nov. 1 to stock of record Oct. 20.

The Ingersoll-Rand Co. has declared a regular quarterly dividend of 2½% on common stock, payable Oct. 31 to stock of record Oct. 18.

The Houghton County Electric Light Co. has declared a semi-annual dividend of 75 cts. a share on preferred stock and 62½ cts. a share on common stock. The former is at the rate of 6% per annum and the latter 5%. Both are payable Nov. 1 to stock of record Oct. 18.

Columbia Gas & Electric Co. has declared a quarterly dividend of 1%, payable Nov. 15 to stock of record Oct. 31.

Sierra Pacific Electric Co. has declared a quarterly dividend of $1.50 on preferred stock, payable Nov. 1 to stock of record Oct. 17.

Cape Breton Electric Co. has declared a dividend of $1.50, also a semi-annual dividend of $3 on preferred stock, payable Nov. 1 to stock of record Oct. 15.

Crocker-Wheeler Co. has declared a quarterly dividend of 2%, also a quarterly dividend of 1¾% on preferred stock, payable Nov. 15 stock of record Nov. 5.

American Telegraph & Cable Co. has declared a quarterly dividend of 1¼%, payable Dec. 1 to stock of record Nov. 29.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Oct. 14.	Bid Oct. 21.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	78	78
American Gas & Electric of New York, common	10+extra	127	128
American Gas & Electric of New York, preferred	6	40	40
American Light & Traction of New York, common	..	230	223
American Light & Traction of New York, preferred	6	94	93
American Power & Light of New York, common	4	..	55
American Power & Light of New York, preferred	6	..	72
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	25	25
American Telephone & Telegraph of New York	..	98⅞	100
American Water Works & Elec. of New York, common	..	5	5
American Water Works & Elec. of New York, particip	7	20	10
American Water Works & Elec. of New York, first preferred	..	58	58
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	21	20
Cities Service of New York, common	+extra	474	467
Cities Service of New York, preferred	6	77½	77
Commonwealth Edison of Chicago	8	109½	107
Comm. Power, Railway & Light of Jackson, common	..	21½	21
Comm. Power, Railway & Light of Jackson, preferred	6	48	49
Federal Light & Traction of New York, common	..	9	9
Federal Light & Traction of New York, preferred	..	45	44
Illinois Northern Utilities of Dixon	6	75	72
Middle West Utilities of Chicago, common	..	30	29
Middle West Utilities of Chicago, preferred	..	50	50
Northern States Power of Chicago, common	..	65	63
Northern States Power of Chicago, preferred	ex.div.7	89	89
Pacific Gas & Electric of San Francisco, common	..	66	65⅛
Pacific Gas & Electric of San Francisco, preferred	6	90	90
Public Service of Northern Illinois, Chicago, common	7	85	83
Public Service of Northern Illinois, Chicago, preferred	6	91	90
Republic Railway & Light of Youngstown, common	4	11	9
Republic Railway & Light of Youngstown, preferred	6	45	44½
Standard Gas & Electric of Chicago, common	..	31	30
Standard Gas & Electric of Chicago, preferred	8	40½	40½
Tennessee Railway, Light & Power of Chattanooga, common	..	4	4
Tennessee Railway, Light & Power of Chattanooga, preferred	6	11	10
United Light & Railways of Grand Rapids, common	4	44	44
United Light & Railways of Grand Rapids, preferred	6	73	72
Western Power of San Francisco, common	..	23	22
Western Union Telegraph of New York	extra	84	85½
Industries.			
Electric Storage of Philadelphia, common	4	143	144
General Electric of Schenectady	8	166½	172½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	55¾	55